PAINT and VARNISH Production

THE TECHNICAL MAGAZINE FOR MANUFACTURERS OF PAINT, VARNISH, LACQUER AND OTHER SYNTHETIC FINISHE

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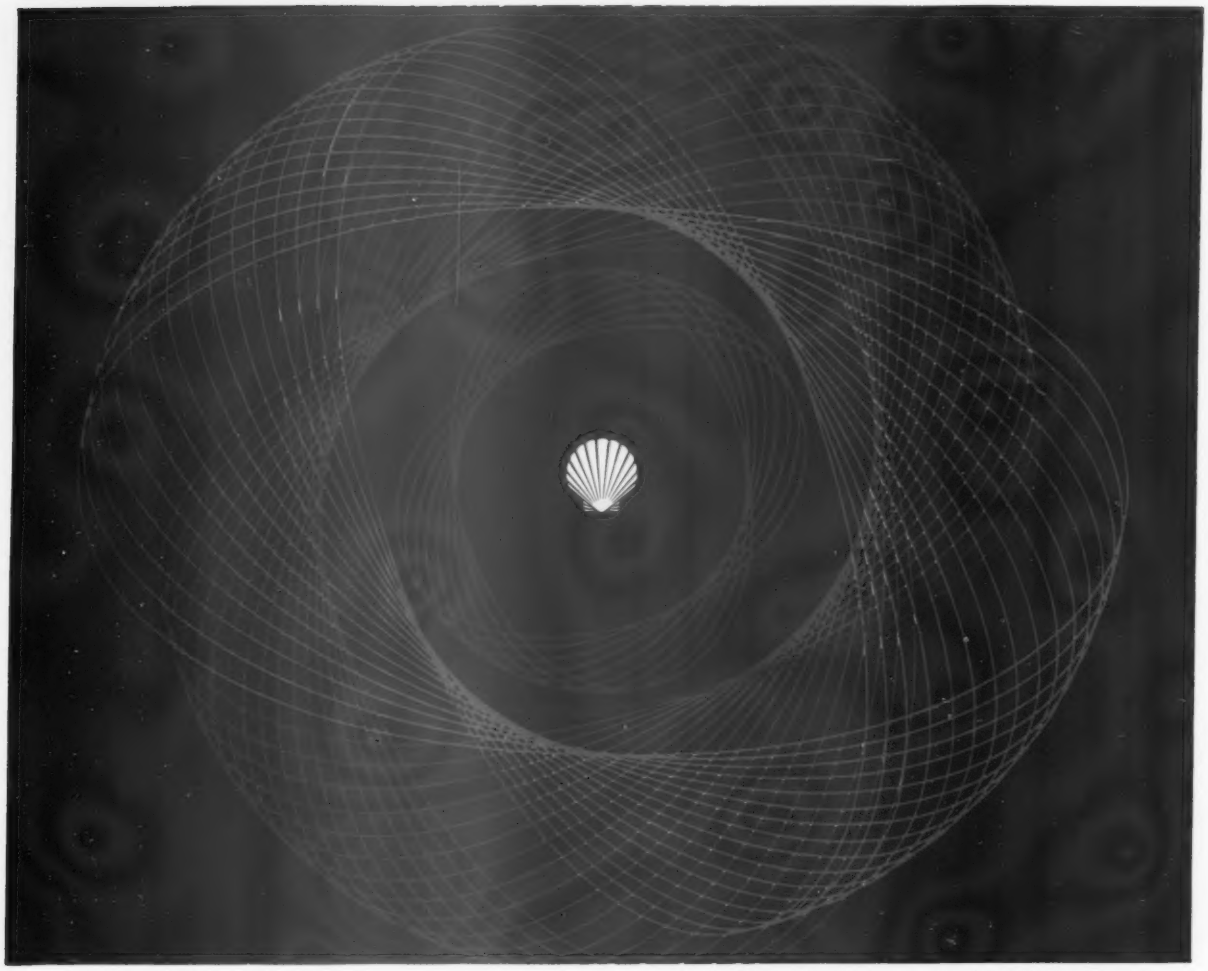
JULY, 1957



"Integration," an impression by C. Arthur Rosser

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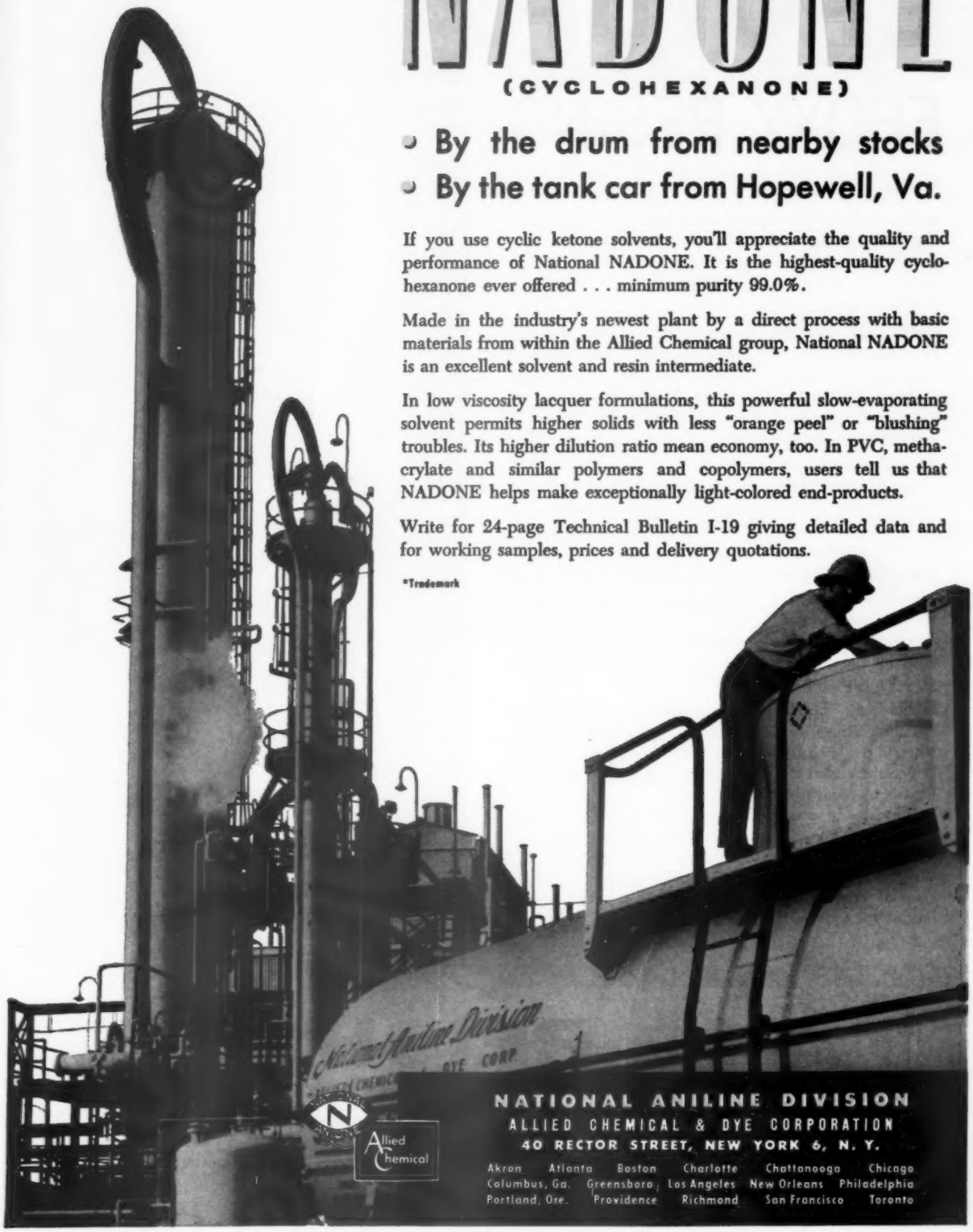

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Formerly PAINT and VARNISH PRODUCTION MANAGER
(Established in 1910 as The Paint and Varnish Record)

VOL. 47 JULY, 1957 NO. 8

NEXT ISSUE

High-low solvent for wood lacquers will be featured in the August issue. This article discusses how the high-low principle may be applied in the formulation of high-build wood lacquers. Film and application properties are also covered in detail.

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FEATURES

Considerations in the Processing of PE Alkyds, *by William M. Kraft, Hyman Metz, and George T. Roberts* 29

Coatings for Automobile Interiors, *by M. M. Gerson* 37

Electrostatic Application of Polychromatic Coatings, *by George E. F. Brewer* 44

Paint Industry in Post-War Europe, *by Dr. Walter B. Maass* 50

Statistical Analysis in a Polymerization Process, *by Louis A. Pasteelnick and William B. Leder* 57

The Coating Corner, *by Phil Heiberger* 88

DEPARTMENTS

Comment 7

News 60

- Organic Coatings Conference 60
- Nuodex Awards at Rutgers U. 61
- High Gloss Latex Formulation 62

New Raw Materials and Equipment 69

- Vat Colors 69
- Resin Granules for Traffic Paint 70
- Heavy-Duty Mixer 71

Personnel Changes 72

Patents 84

- Protein Stabilizer 84
- Vinyl Coating 85
- Wood Stain-Filler 86

Calendar of Events 94

Technical Bulletins 100

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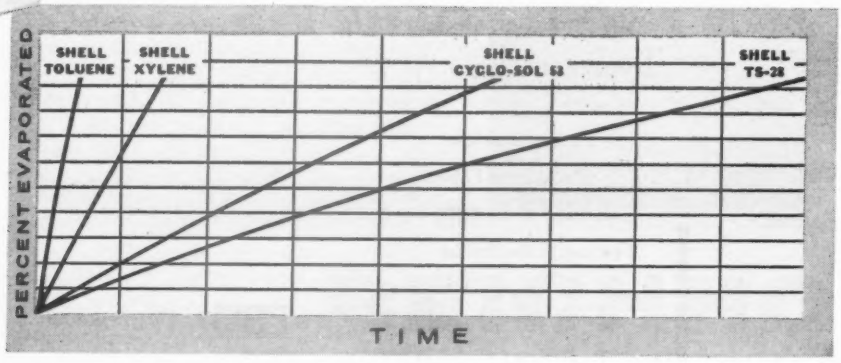

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Housing Upturn Predicted

INDICATIONS are that this year will see a marked decline in the construction of new private dwellings as compared to previous years. For the past eight years more than a million homes were built annually. In 1955, the peak year, 1,329,000 units were built. Last year this total dipped to 1,118,000 and 1957 is expected to be less than 1 million units.

"Tight money" has been chiefly responsible for the present decline in housing activity. Other factors which have had some effect on the present housing picture include consumer resistance to rising costs, upgrading of housing demand, localized overbuilding, and a diminishing supply of building sites.

In evaluating this situation, Melvin H. Baker, chairman of the National Gypsum Company, told a recent meeting of the New York Society of Security Analysts that money for home mortgages is easing a bit, the vacancy rate is low and the number of families keeps rising. If this trend continues, he predicted that home starts should get back to something more than a million by 1958.

Elaborating further, Mr. Baker listed the following factors that would materially help in maintaining private building activity at a high level:—

"A pent-up demand (for housing) is growing, and it cannot be satisfied by the present rate of home building.

The birth rate of about 4 million per year is creating cramped quarters for young couples who live in small homes, and this is causing a pressing need for new homes.

A fairly high level of family formations is indicated until the 60's, when a substantial upturn can be expected.

There will be a need to replace an estimated 400,000 homes each year, expected to be demolished for roadways, urban redevelopment and to replace those destroyed by natural causes.

A larger number of over-age structures are wearing out or becoming obsolete.

There is a growing trend to get out of the crowded city by building a home in the suburbs.

The demand continues to grow for more public, commercial and industrial buildings necessary to properly accommodate the rapid increase of our population.

Continued growth in our economy will cause full time jobs at high wages and, consequently, provide prospects for savings by the American people."

Aerosols Spurt Ahead

AT the recent Chicago meeting of the Chemical Specialties Manufacturers Association, it was announced that the 11-year-old aerosol industry passed its billionth package mark late in 1956. Some 320 million units were produced during 1956, according to the annual aerosol production survey conducted by CSMA.

Pigmented and metallic paints and clear plastic sprays increased sharply in 1956, with last year's production of 22,557,418 units more than doubling the 1955 figure of 9,247,510 units. In analyzing the 1956 volume, paints represent 7 per cent of the total aerosol production on a unit basis.

FOR THE PAINT, VARNISH AND LACQUER INDUSTRY

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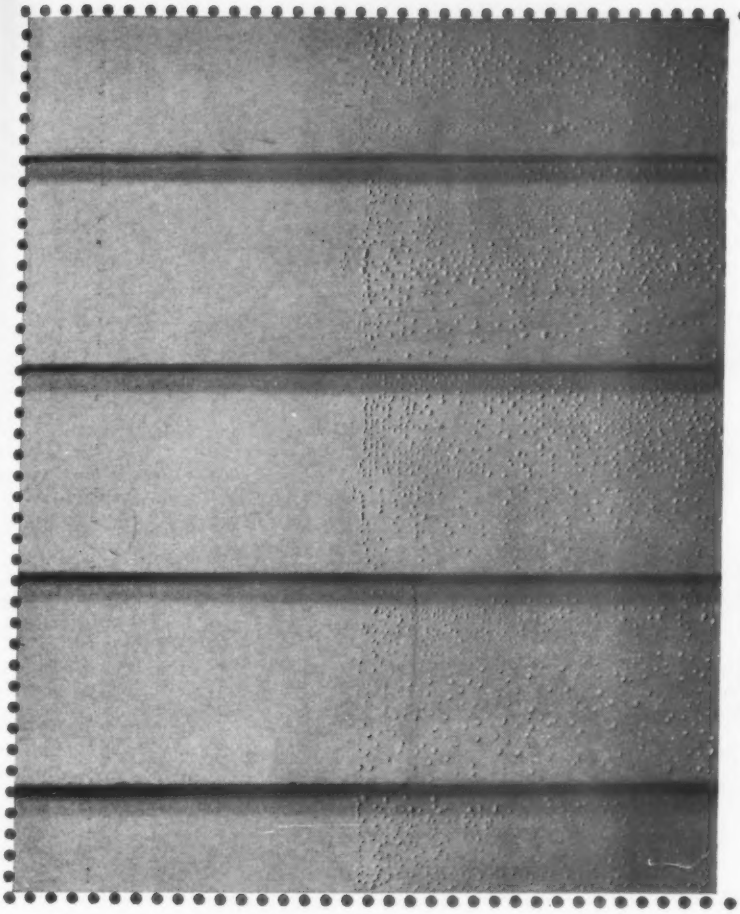
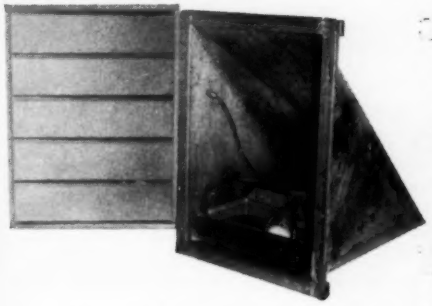


Left: *Closeup of clapboard panels tested in National Lead Laboratory's Blister Box. The blister-free surface was coated with primer containing new "45X" Red Code. Compare it with the blistered area coated with ordinary primer.* Below: *Blister Box exposes panels to intensive humidity in order to measure the relative blister-resistance of different primers.*



For Blister-Resistant Exterior Primers

New Dutch Boy®

"45X" RED CODE

(Basic Silicate White Lead)

Want to keep dealers and customers happy . . . and sold on the high quality of your paint products? You can do it by producing a primer with higher resistance to blistering.

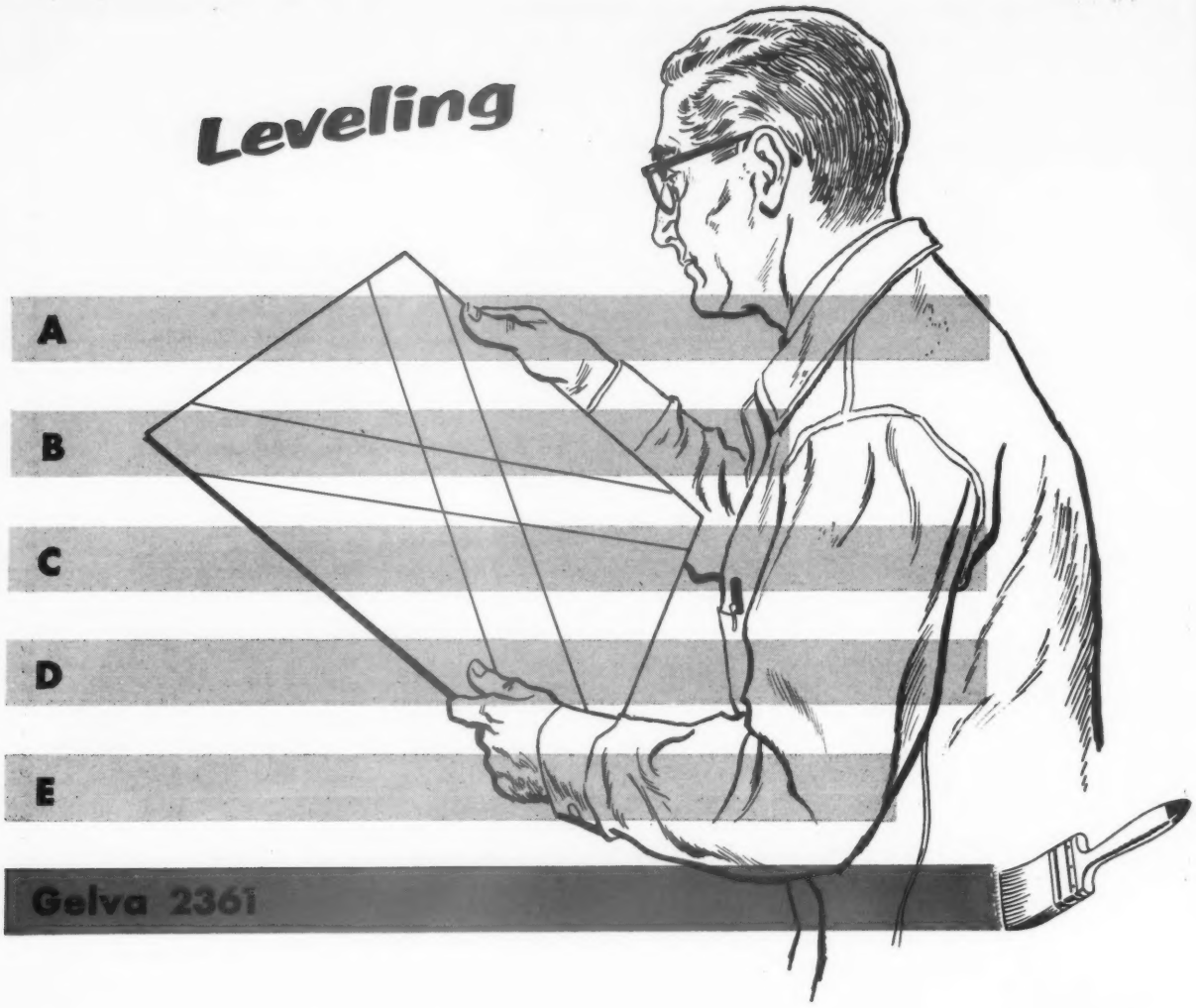
New "Dutch Boy" Basic Silicate White Lead "45X" Red Code was developed specifically to solve blistering problems in exterior primers. Its remarkable blister-resistance has been proved in many intensive tests over a period of years.

And "45X" Red Code imparts a high degree of *package stability when used with primer vehicles* — another performance "plus" that builds consumer preference for *your* primer.

The blister-resistance and package stability of new "45X" Red Code are combined with many other desirable primer properties. New "45X" provides the lead soaps needed to promote adhesion . . . and gives film the water resistance necessary to maintain its adhesive bond and help prevent peeling.

And with all these important marketing advantages, you also benefit from the well-known production economies provided by "45X".

NATIONAL LEAD COMPANY: *New York 6; Atlanta; Buffalo 3; Chicago 80; Cincinnati 3; Cleveland 13; Dallas 2; Philadelphia 25; Pittsburgh 12; St. Louis 1; San Francisco 10; Boston 6 (National Lead Co. of Mass.). In Canada; Canadian Titanium Pigments Ltd., 630 Dorchester St., W., Montreal.*



how Gelva base paints compare in tests with other types of interior paints

(one of a series)

Using standard test methods and assigned ratings on a scale from 10 to 0—good to poor, a typical GELVA paint formulation compares impressively in degree of leveling with commercial paints bought on the open market.

A represents a PVAc base paint
B represents a styrene butadiene base paint
C represents an acrylic base paint
D represents an alkyd base paint
E represents the average of eight paints tested
GELVA 2361 represents a Shawinigan PVAc paint formulation

This is factual evidence of extra value for paint manufacturers who use GELVA emulsions in their paints. Shawinigan's unequalled experience and continuing research are good reasons for specifying GELVA. For formulation data in booklet, "Gelva Emulsions for Paint," write Shawinigan Resins Corporation, Department 2207, Springfield 1, Mass.

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for synthetic latex paints

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Tributyl Phosphate is an odorless and colorless liquid, is miscible with most common organic solvents, and is a good solvent for a variety of other materials. It has a surprisingly low melting point for such a high-boiling liquid.

Molecular Weight:	266.316 (calc.)
Boiling Point at 27 mm:	177°C-178°C
Freezing Point:	<—80°C
Density at 20°C:	0.982
25°C:	0.978
Weight per U.S. Gallon at 68°F:	8.19 lb.
Coefficient of Expansion:	0.00093 per 1°C
	0.00052 per 1°F
Refractive Index, n_D at 20°C:	1.424
25°C:	1.422
Viscosity at 25°C:	3.41 centipoise
85°F:	38.6 Saybolt seconds
Latent Heat of Vaporization:	55.1 cal/g
Specific Heat	0.43 cal/g
Dielectric Constant at 30°C	7.97
Flash Point, Cleveland Open Cup:	249°F
Solubility in Water at 25°C:	6.55% by volume
Solubility of Water in Tributyl Phosphate at 25°C:	<1% by volume

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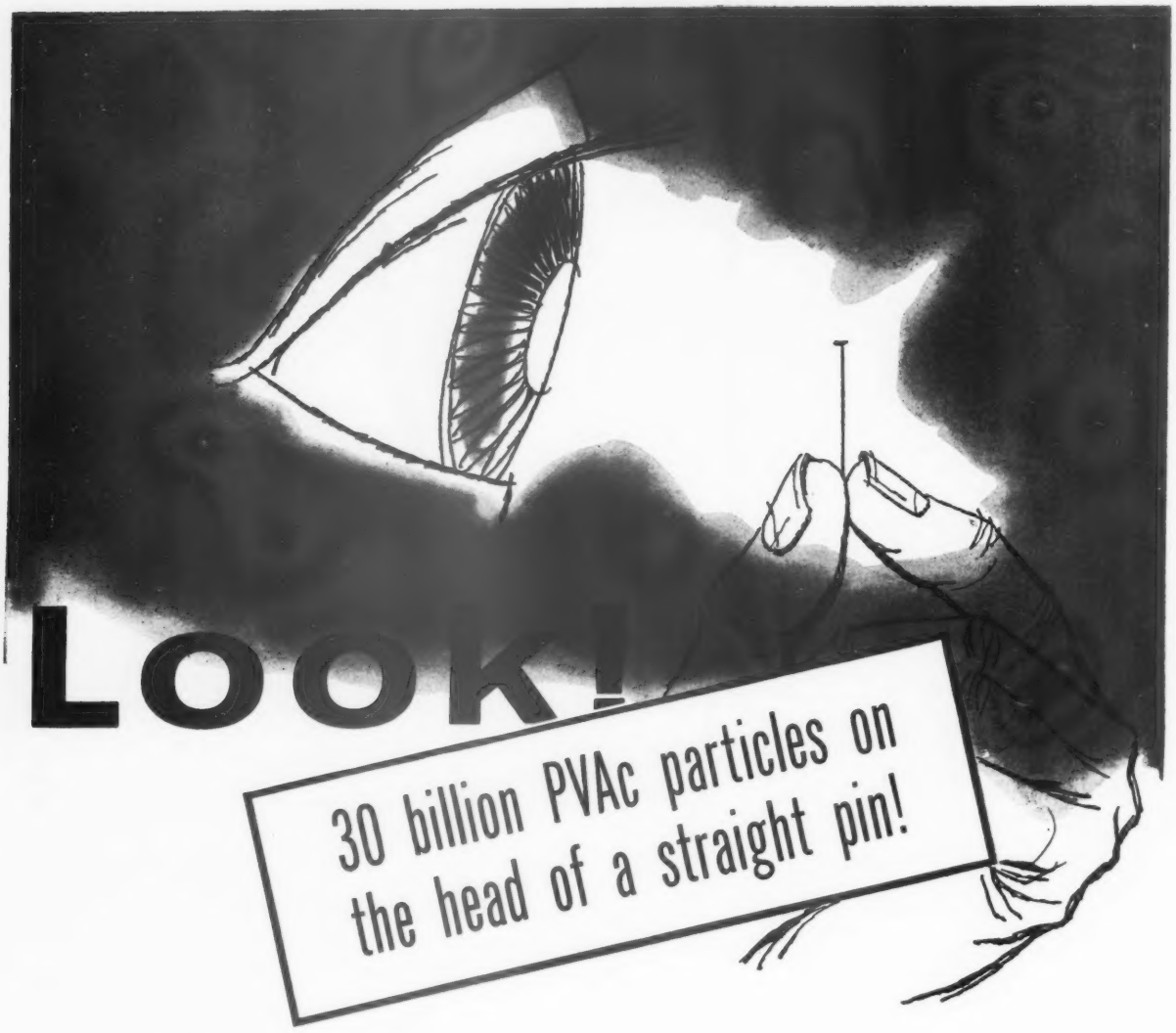

HQ* CELANESE PVAc EMULSIONS GIVE YOU THE FINE PARTICLE SIZE YOU NEED TO MAKE BETTER PAINTS

Consider this—if Celanese CL-102 or CL-202 emulsion particles were "stacked" in the densest packing, and if these particles were to retain their spherical shape, the volume of the head of a common straight pin could contain 30 billion of these particles!

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A Celanese Technical Representative will be happy to discuss the relative characteristics of Celanese CL-102 Homopolymer and CL-202 Copolymer and assist you with your interior or exterior formulations. Write for your copy of the free manual that shows how to find the big difference in emulsions.

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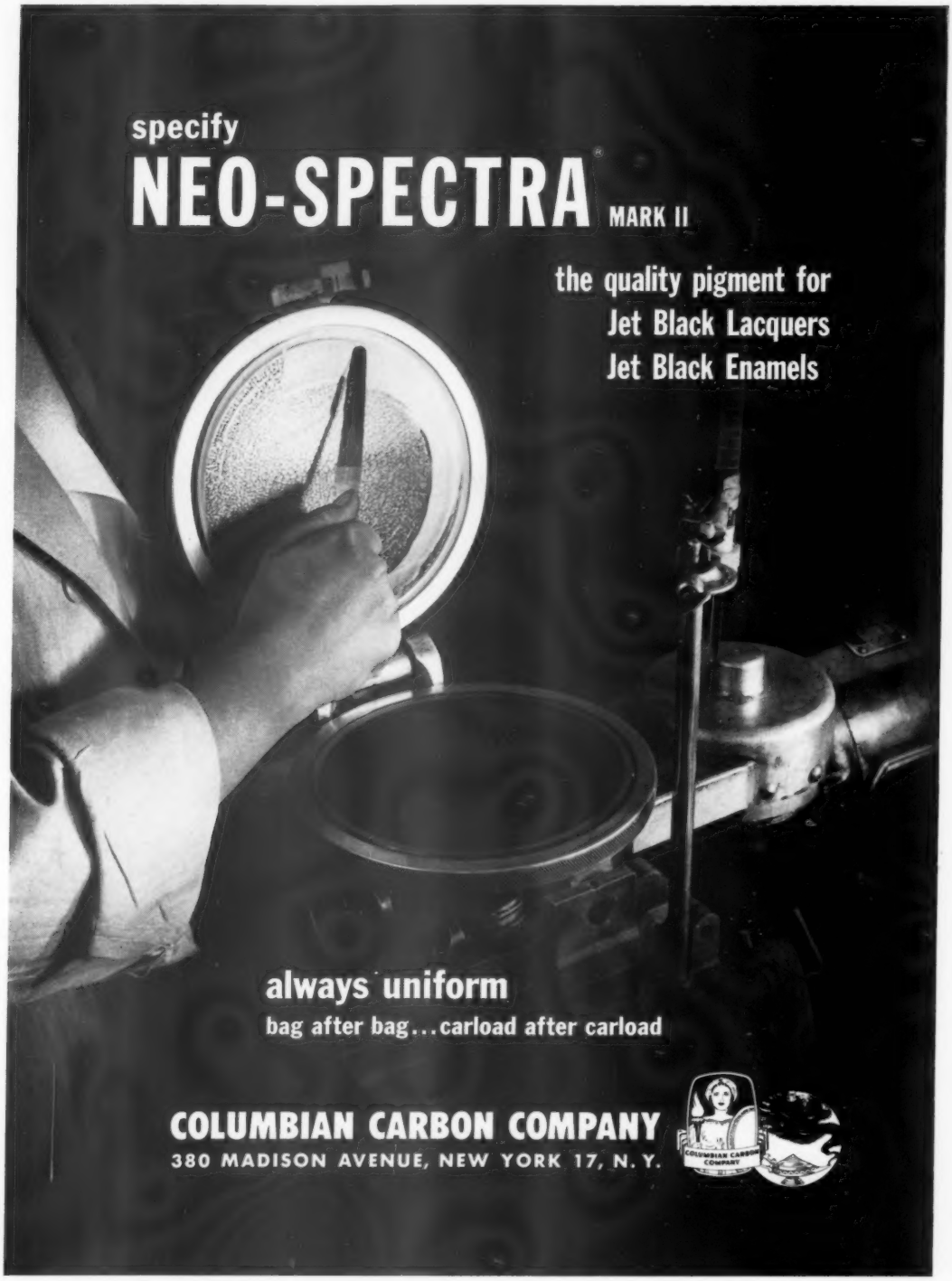

Columbian's Branch Offices and Agents
are listed on the following page

How Columbian pioneering brought permanent mirror-gloss and extreme jetness to nitrocellulose lacquers

Both nitrocellulose lacquers shown are pigmented with the same concentration of the same carbon black. The one at the right was made by the old ball mill method once standard in the industry. It could be given a high polish but weathering would soon dull its surface. To the left is a modern nitrocellulose lacquer made with a Columbian dispersion — its high gloss remaining undulled by weathering. Columbian was the first to produce such a dispersion by a combination of mechanical and chemical means. So superior in jetness and permanent gloss were lacquers made with the new Columbian dispersions, that the old ball mill method has disappeared from commercial use. Now you can make these high grade lacquers by using Columbian's Coblac® 405 . . . Today, these Columbian dispersions have many good imitators . . . but Columbian continues to pioneer . . . to be first with improvements. When you deal with Columbian you know you are always using the most improved carbon blacks.

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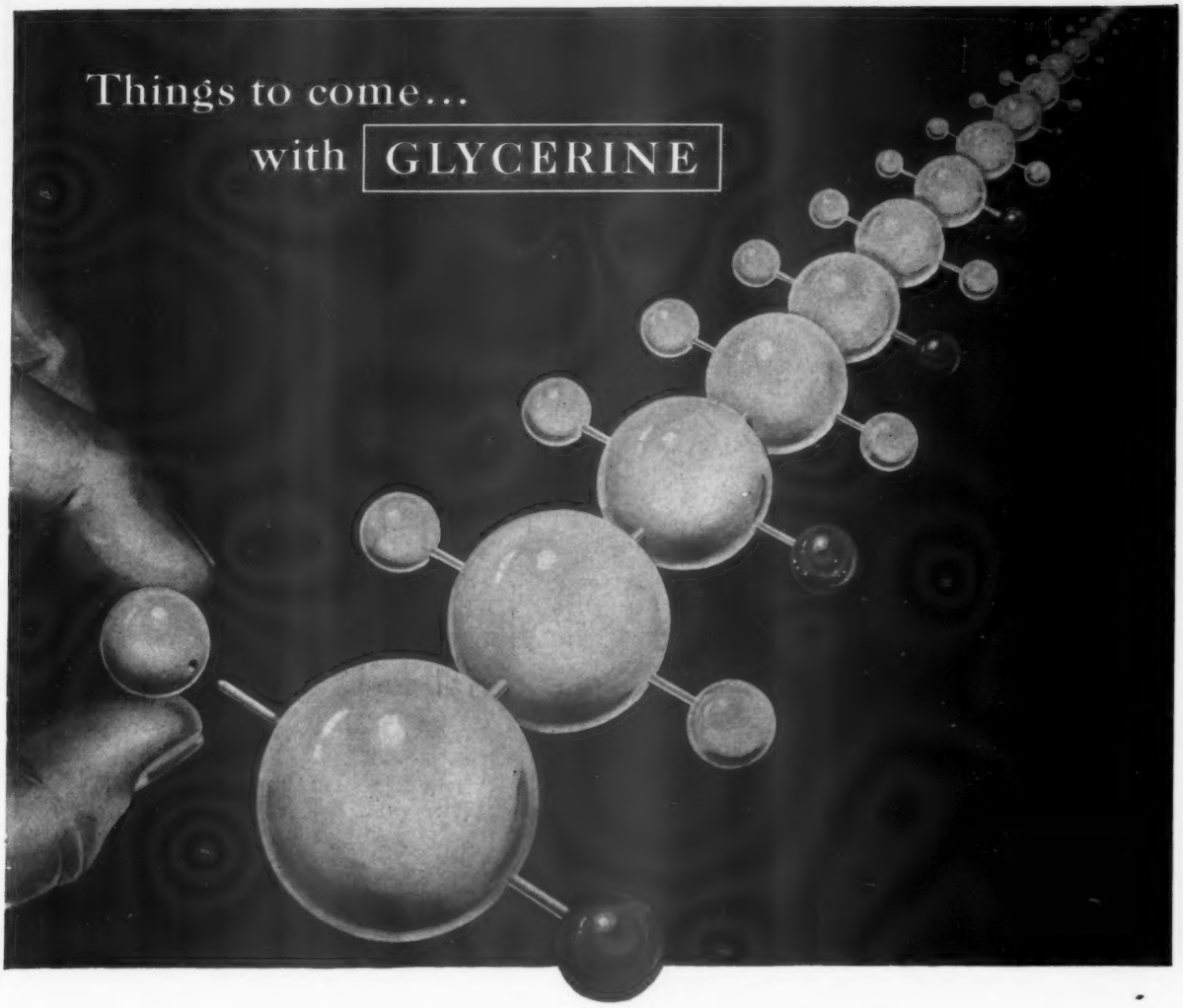

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The reaction brought about with this new process is claimed to yield polymers with molecular weights far in excess of those obtained by conventional methods. Work is under way to develop commercial possibilities of these new polymers.

*Developed by Dr. G. Oster, Polytechnic Institute of Brooklyn

Glycerine's usefulness continues to grow. Stable in price, dependable in supply, Glycerine offers processors a unique balance of properties: It is hygroscopic, nontoxic, stable, nonvolatile, with excellent solvent power and agreeable taste. New applications for Glycerine are extending its use in paints, foods, pharmaceuticals, packaging and many other fields. For a handy 20-page booklet, "Glycerine Properties and Uses," write to:

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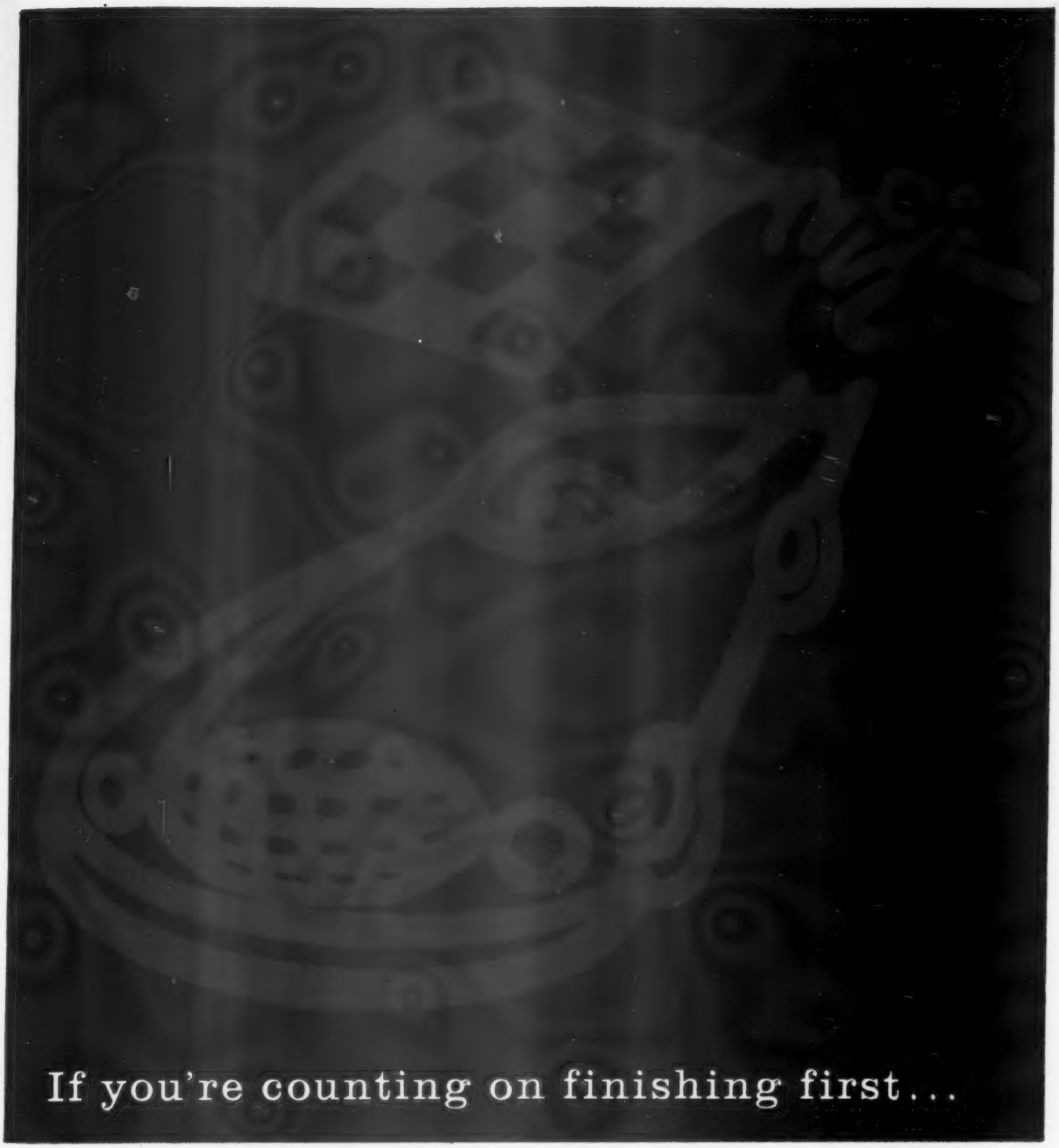

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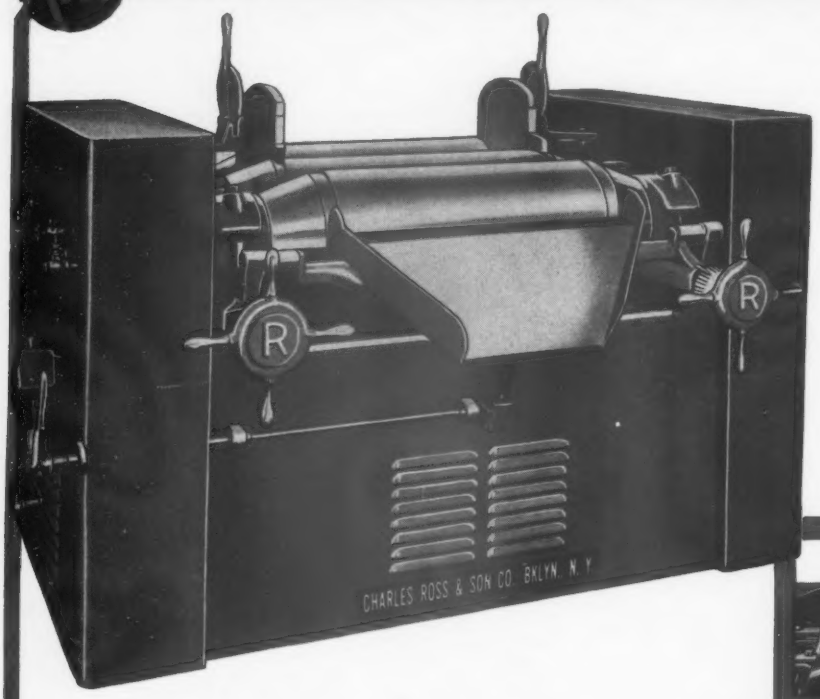

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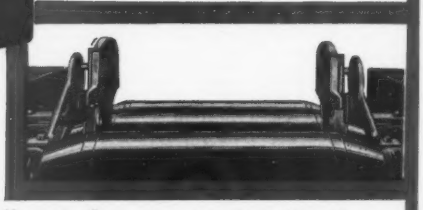

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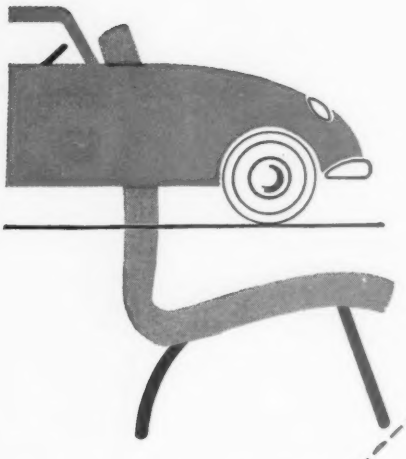

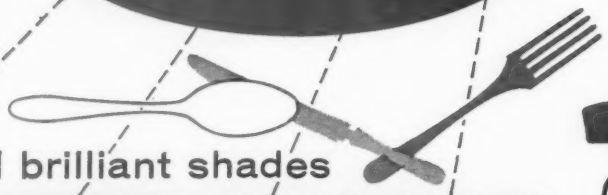

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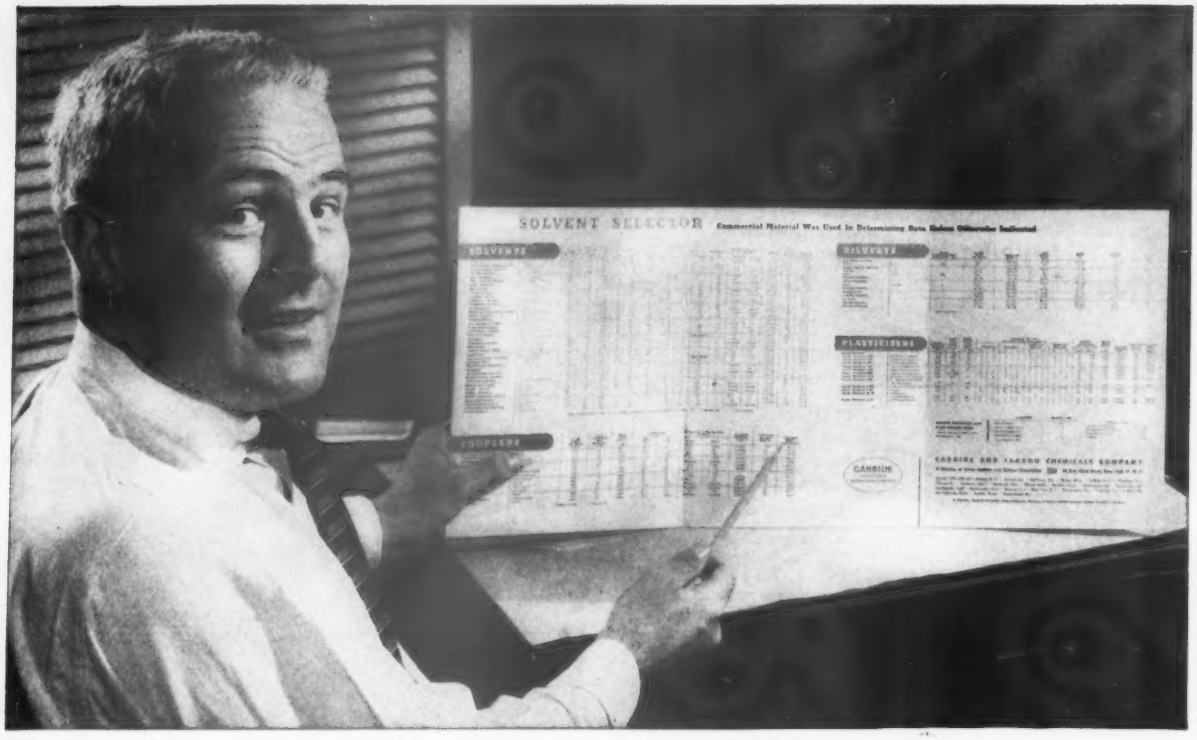

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The results are in! ⟶

Excellent... Everywhere!

TEXAS CITY, TEXAS

Surface Painted, southern yellow, pine clap-

FORT LAUDERDALE, FLA.

Type of Surface, chalking stucco -

CHICAGO, ILLINOIS

PHOENIX, ARIZONA

Surfaces Painted, previously p

MCKINLEY, MAINE

FARGO, N. D.

clapboard,

SPRINGFIELD, MASS.

SODA SPRINGS, IDAHO

Type Surfac
Length of
Type of
relati
high
Resu

Surfaces Painted, ceme
painted wood and cement
Length of Exposure, two
Climate, low temperature,
of moisture -
Results: Excellent

NASHVILLE, TENN.

Surface Painted April 1955; used brick, cement shingles, wooden sash
Climate: mild, relatively moist, fair amount of sunshime.
Test results to date: EXCELLENT!

Exterior paints made with Lytron 680 were tested for 2 years on used brick, cement shingles, wooden sash, chalking stucco, blistering cedar clapboard, cedar shingles, pine clapboard, cement block, painted and unpainted brick—in all kinds of weather. Here are the results.

SAN DIEGO, CALIF.

Surface Painted, chalking stucco -
Length of Exposure, two years -
Type of Climate, fair amount of moisture, salt air -
Results: Excellent!

SEATTLE, WASH.

Surface Painted, blistering cedar clapboard -
Length of Exposure, two years -
Type of Climate, high amount of rainfall, low percentage of sunshine, salt air, and mildew problems -
Results: Excellent!

A series of full scale house expo sures was made to obtain practica field results regarding applicatio and weathering characteristics o exterior paints made with Lytro 680 . . . at temperatures varyin from 38° F. to 107° F. . . . . on con crete, stucco, and masonry, previ ously painted pine and cedar, shin gles, shiplap siding and clapboard The paint for these tests was mad in commercial plants in productio size batches, applied by profes sional painters and home owner in a number of different climati areas from tropical Florida to Que bec, Canada; from the Coast o Maine to California; includin desert Arizona; cold, dry Idaho Seattle, Washington; Fargo, Nort Dakota; and others with specia climatic conditions.

Background for the tests

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How does LYTRON 680 measur up to these specifications?

A chemically unique Acrylic type polymer latex, LYTRON 680 a synthesis of monomers well ba anced to form a smooth flexibl

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lm even at temperatures less than)° F. without modification.

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LYTRON 680 films do not rupture ı porous substrate. There's no)lor mottling or spotting. Blister- ıg, even over green masonry is ıinimized.

Controlled, small particle size ıs assured proper binding of high)lumes of pigment to form paint lms with excellent adhesion, color :tention and resistance to sub- ırate alkalinity without sacrific- ıg stability.

Although LYTRON 680 was devel- ped as a binder for exterior paint, :atures have been incorporated hich make LYTRON 680 equally seful, either as a sole vehicle, or s a modifier for other alkaline la- x vehicles, in high quality inte- or paints.

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Considerations in the

PROCESSING of PE ALKYDS*

By
William M. Kraft
Hyman Metz
George T. Roberts

THE progress made in the surface coatings field may be traced directly to the attempts to upgrade natural oils. As the result, improved film characteristics, application, and physical properties have been achieved.

One approach to these improvements has been the preparation of alkyd resins from the natural oils. The alkyd manufacturer then uses the oil as the source of the resin modifier, the long chain monobasic fatty acids. The choice of the particular oil will, of course, depend on the specific application, quality and properties of the final product, and economic factors such as cost, availability, and competitive sources for the fatty acid modifiers.

Since it is usually necessary to carry out an ester interchange or alcoholysis reaction when an oil is used in an alkyd cook, the initial objective of the work performed in the Heyden Newport Research Laboratories was to develop information on those conditions which produce the best alkyd resins. These were to be the optimum in terms of resin solution colors, as well as in film properties. Since a large volume industrial resin would best serve as a basis for study, the 52R13 (TTR 266 Type 1A) was chosen. A standardized technique of laboratory preparation was developed which gave good reproducibility of results. As might be expected, several difficulties were encountered which were due to mechanical and physical as well as chemical factors. The procedure detailed below describes the final method used.

To our knowledge, a complete study of the preparation of pentaerythritol alkyds from natural oils has not been described in the literature so as to include the description of the alkyd resin and its solution properties. Previous work in our laboratory (Davis, Balgley and Wiech—*Alcoholysis of Drying Oils with Pentaerythritol*, Official Digest, No. 326, 203-206, (1952)) described the soybean oil—PE reaction in the presence of litharge, calcium oxide, lithium and sodium hydroxide, lithium carbonate, sulfur and cobalt naphthenate. The two latter materials appeared ineffective in the reaction while the effects of the others on the color of the alcoholyzate were determined. Our more recent investigations are concerned mainly with the effects on alkyd resin color since this is a property of high interest to the paint manufacturer. The subsequent evaluation of these resins then showed results of the effects on film properties. During this phase of the problem several important leads to other improvements in resin properties developed. These are being pursued at the present time.

The alkyd manufacturer is constantly faced with the problems of obtaining the lowest resin color, shortest reaction times, best handling properties and techniques, in order to produce a satisfactory material for sale at a profit. To do so, he insists on high quality ingredients, and rightly so, since with a given set of operating conditions the lowest color resins are those produced with the best quality raw materials. With the information gained from this investigation, improvements have been made along the lines of providing the lowest color materials not only on a laboratory scale but also in commercial full plant scale installations.

Alcoholysis Catalyst Concentration

The initial objective was to study the effect of the variation of catalyst to determine the optimum level in terms of rate and color. This information was developed for soybean oil.

The typical procedure used is as follows:

Weigh into a tared one liter, three-necked round-bottomed flask with thermometer and stirrer attached,

290 g. alkali refined soybean oil
0.029 g. litharge
71 g. pentaerythritol (technical) (0.49 moles).

Heat with a Glascol heating mantle suitably controlled by a variable transformer, under an inert gas blow (CO_2 cylinder) and a stirring rate of 300 RPM over a two hour period to 230°C. Hold at 230°C. until clear, noting time at which clarity occurs. Take a small sample (into a Gardner viscosity tube) at 10 minute intervals from the time 225-230°C. is reached. Note color of the alcoholyzate and determine the dilution ratio with anhydrous methanol. At 2:1 or higher, alcoholysis is complete.

Add 120 g. of phthalic anhydride (0.81 moles) and connect for a solvent type cook (attach a Dean-

*This paper is the result of experimental studies carried out by the Research Department of Heyden Newport Chemical Corp., and was presented at the 11th Divisional Protective Coating Conference, Chemical Institute of Canada.

Stark trap surmounted with a water condenser and add 20 ml. xylene to the batch). Cook at 240-245°C. until an acid number of 10 or less is reached. Thin to 70% with mineral spirits. Determine the color and viscosity of the diluted resin.

Notes.

1. On the basis of previous work, detailed later in this paper, it was found that better duplication could be obtained by charging the catalyst, oil and polyol together in the cold rather than using a hot addition technique.
2. Better duplicability of viscosity, cook time, color, and acid number was obtained by using a solvent type cook during the esterification stage rather than a fusion cook. This may be ascribed to the greater control of phthalate content (less volatile loss of phthalic) as well as elimination of chance exposure to air.

Film properties were determined by the usual techniques which are similar to those described in the recent *Paint, Oil and Chemical Review* report on Polyhydric Alcohols (1953). With each oil, all of the film data for the variously catalyzed resins were determined at one time whereas the data for different oils were developed at different times. This was necessitated by the large number of resin systems under study.

As can be noted, the extent of alcoholysis was determined by dilution of the hot alcoholyzate with cold methanol (clarity at a 2:1 methanol:alcoholyzate ratio indicated completion). Comparison of this test with the test based on reaction with a small amount of phthalic anhydride gave similar conclusions as to completeness of reaction.

TTR-266 Soy Oil PE Alkyd

Litharge % on oil	Alcoholysis Color	Alcoholysis Time	Resin (70% in M.S.) Color	Resin (70% in M.S.) Viscosity
0.005	5	40	5	Z
0.008	5−	25	5	Z
0.010	5−	20	5−	Z+
0.020	5	10	6−	Z
0.030	5+	5	6	Z

Table 1. Litharge Catalyst Variation at 230°C.

The results in Table 1 indicate that litharge at 0.01% on soybean oil leads to low colors. A noteworthy factor is that the frequently used higher concentrations may give faster rates in the alcoholysis reaction but the color of the alkyd degrades badly. With the commonly available raw materials the recommended level of catalyst results in usual reaction periods with no difficulty due to hazy or cloudy alkyds.

The proper level of alcoholysis catalyst may be determined in another manner. This involves measurement of the progressive color changes of the alcoholyzate when held at the alcoholysis temperature for extended periods. The optimum catalyst concentration is the one where no increase has occurred (0.01% in Table 2).

The progressive increase in color noted at levels of 0.015% and higher indicated this to be the preferred upper limit in catalyst concentration at this particular alcoholysis temperature.

Obviously the concentrations are those used in a clean kettle. The presence of acidic residues from previous batches (unreacted phthalic acid or anhydride in particular) will require sufficiently greater amounts of catalyst to overcome the neutralization by the acid.

% Litharge	Time to Complete Alcoholysis	Gardner Color at Completion	Gardner Color After Minutes Beyond Completion 10	20	30
0.006	40	5−	5−	5−	5−
0.008	25	5−	5−	5−	5−
0.010	20	5−	5−	5−	5−
0.015	15	5−	5−	5−	5−
0.02	10	5	5	5	5+
0.03	5	5+	5+	6	6+
0.05	Immediate	6	6+	7	7

Table 2. Alcoholysis of Soy Bean with "Pentek" at 230°C—Alcoholyzate Color.

Alcoholysis Temperature

As might be anticipated from experience, the level of the alcoholysis temperature will also affect the resin color. This is demonstrated in Table 3 for soy bean oil-PE alkyds with 0.01% litharge. As can be seen from Table 3, Source A pentaerythritol can be alcoholyzed at 210°C. with no abnormal times to obtain low resin colors. The extended periods required at 210°C. and even at 230°C. for the Source B material (both were technical products) require adjustments in processing schedules.

Technical Pentaerythritol	Alcoholysis Temp. °C.	Alcoholysis Time Minutes	Final Resin Color (70% Solution)
Source A	245	10	5
	230	20	5− (Control)
	220	50	4+
	210	80	4
Source B	230	70	5−
	210	150	5−

Table 3. Variation in Alcoholysis Temperature (Phthalic Esterification at 245°C) 0.01% Litharge

In order to counteract the longer period required for completion of alcoholysis at 210°C. a study was made of the effect of increasing catalyst concentration with Source A. This is summarized in Table 4.

% Litharge	Alcoholysis Time (minutes)	Resin Color 70% Solution
0.01	80	4
0.015	54	4
0.02	40	4
0.03	31	4+

Table 4. Variation in litharge Content Alcoholysis at 210°C. Phthalic Esterification at 245°C.

More rapid reaction in the resin system also enables shorter cycles which can lead to lower resin colors, smaller processing costs and more effective use of equipment.

The use of extremely high alcoholysis temperatures together with high catalyst concentrations leads to

greater resin color and, frequently, hazy alkyds which are filtered with difficulty. Table 5 describes these effects.

% Litharge	Alcoholysis Temp. °C.	Alcoholysis Hold Time	Alcoholysis Color	70% Resin in MS Color	70% Resin in MS Clarity
0.01	230°	40 min.	4+	5	clear
0.01	255°	60	5+	6	slightly hazy
0.05	255°	60	9+	8+	hazy

Table 5. 22% Phthalic-Soy Oil Alkyds

Type of Alcoholysis Catalyst

A study of the type of catalyst (litharge, lithium hydroxide, sodium hydroxide, calcium naphthenate and calcium hydroxide) was made for each of the listed oils in the long oil PE alkyd formulation. The catalyst concentrations (based on oil) used in this study were:

Litharge	0.008, 0.01 and 0.02%
Lithium hydroxide	0.01 , 0.03 and 0.05%
Sodium hydroxide	0.01 , 0.03 and 0.05%
Calcium naphthenate (as Ca metal)	0.008, 0.01 and 0.03%
Calcium hydroxide	0.008, 0.01 and 0.03%

Table 6 indicates the optimum catalyst concentration as determined by lowest color, fast reaction and freedom from dehydration and haze in the alkyd processing. This is a synopsis of an extensive evaluation of resin and film properties of the various alkyds.

Soy bean oil	0.01% Litharge
Linseed oil	0.03% Lithium hydroxide
Dehydrated Castor oil	0.01% Litharge
Safflower oil	0.01% Litharge or 0.01% calcium metal as the naphthenate
Coconut oil	0.03% Lithium hydroxide

Table 6. Preferred Alcoholysis Catalysts

Some miscellaneous observations might be made at this point. Sodium and calcium hydroxide generally were slow catalysts at 230°C. The use of higher concentrations (>0.03%) with calcium compounds frequently leads to haze in alkyds whereas the sodium catalyzed systems generally were sparklingly clear even where colors were frequently dark.

In some experiments calcium salts resulted in amounts of water in excess of that calculated for the esterification. This was presumably due to dehydration.

In general, the rate of the alcoholyzed oil-PE reaction with the phthalic anhydride was independent of the type of catalyst. There were, however, different rates for the various oils.

Dehydrated castor > Linseed >Safflower = Soy = Coconut

As might be expected, the oil length of the alkyd might also affect the alcoholysis reaction.

Table 7 indicates the effect of oil length on methanol dilution test, viscosity and color.

Oil Length in Percent	80	70	65	62	56
Alcoholysis Time minutes	40	40	30	10	20
Methanol Dilution Alcohol/Alcoholyzate	0.5/1	1/1	2/1	2.75/1	3.25/1
Resin Color (70% Soln.)	4+	4+	4	5−	6
Viscosity (70% Soln. in MS)	A-1	F	Q	Z+	Z7+

Table 7. Variation of Oil Length of Soy Bean Oil-PE Alkyds Catalyzed by 0.01% Litharge

There was a corresponding decrease in dry times and increase in hardness, alkali and detergent resistances as the compositions were varied from long to medium oil length.

Improving Color

As indicated in the opening remarks to this paper, there are many factors which contribute to alkyd color. The contribution of the alcoholysis catalyst has been described. The next portion of the discussion will refer to other means of improving the color of alkyd resins.

Method of Addition. The exposure of oil to the atmosphere is known to have a deleterious effect on resin color. A given processing technique could therefore result in more or less attack by air. In this regard a question was raised as to the point and in what manner the pentaerythritol should be added to oil. The data in Table 8 indicate the value of charging all ingredients to the cold kettle rather than adding the PE to the hot oil as is done by some processors. The latter method could sweep air into the kettle during the raction. The effects of lower catalyst concentrations are also worth noting.

Technical PE	Method of Addition	% Litharge on Oil	Gardner Resin Color (70% Solution)
Source A	Cold	0.1	6+
	Cold	0.02	5+
	Hot	0.1	7
	Hot	0.02	6

Table 8. Resin Preparations Using Different Methods of Addition

However to avoid difficulty it is necessary that the stirring action be sufficient otherwise charring of the PE might result. Where this is a problem the PE could be added at 180°C. or lower, together with the catalyst.

The alkyds in each case were soy oil, 52R13, types.

Additives for Color Improvement. The use of an additive for color improvement might be of interest to the alkyd processor particularly if it were readily available, economical and have little or no effect on the normal processing conditions. Water is such an additive. It has been found in our laboratories that the addition of from 10 to 20% of water, based on the PE charged, to the cold kettle containing the oil, catalyst and polyol, followed by the usual alcoholysis reaction, often results in resin color improvement.

A similar result might be achieved through the use of a high rate of sparging with an inert gas, but this would probably be, economically, a disadvantage.

Since the water appears to serve either as an inert blanket or as a means of steam distilling color-forming constituents in the system and is not present when the system reaches the alcoholysis reaction temperature, no difficulties are encountered during processing. (*The addition of water to a hot oil is expressly forbidden*!)

The technique of water addition is also successful in reducing the color of fatty acid alkyds but to a lesser degree than for oil modified resins, Table 9.

PE Technical	Amount of Water % on PE	Final Resin Color 70% Solution
Source A–1	0	5+
	10	5
	20	4+

Table 9. Effect of Water Addition on Resin Color

The effects of cold addition and the water addition in our experience do not appear to be additive with those of catalyst effect.

The effects of other processing variables on the properties of pentaerythritol alkyds have also been studied. A frequent comment heard from the industry is that there appear to be differences in the filtration rates of alkyd resin batches. The study has substantiated these observations in the main, and has also indicated some of the pertinent factors affecting their behavior. The following description details the conclusions derived from this work.

It was necessary to establish first a means of determining filtration times for alkyd resin solutions. The method finally used involves filtration of a known volume (50 ml.) of a 70% N.V. alkyd solution in mineral spirits (the alkyd was generally a 52R13 type, the preparation of which was given in the early discussion in this paper) through a Buchner funnel (Coors #1) with Whatman #1 filter paper (5.5 cm. size) into a calibrated receiver at a constant temperature and pressure (25 ± 1°C./20 mm). Zero time is set where the first drop of filtrate appears and the final time where the vacuum is broken due to the lack of material on the filter paper. This permits time determinations even where considerable frothing may occur.)

The effects studied and their results were as follows:

1. *Temperature of alcoholysis* (230°C. as control)
   a. Lower temperature, 210°C., decreases filtration time. Increases actual alcoholysis time.
   b. Higher temperature, 250°C., increases filtration time. Decreases actual alcoholysis time.
2. *Temperature of esterfication* (245°C. as control)
   Lower temperature, 230°C., raises the level of filtration times. Increases reaction time.
3. *Alcoholysis hold times* (0:45, 1:45 and 2:45)
   Longer hold times decrease filtration times, increase reaction times, color and final acid number at equal viscosities.
4. *Use of a condenser during alcoholysis*
   Increases filtration times in general and eliminates time effects of long alcoholysis hold times. Decreases color and final acid number at equal viscosities.
5. *Inert gas flow* (1.2 cfm for a one liter batch as control)
   Lower (0.6 cfm) gas flow increases filtration time and decreases final acid number at equal viscosities.
6. *Miscellaneous*
   a. Acid number has no effect on filtration time.
   b. Viscosity. High viscosity resins result in increased filtration times.
7. *Catalyst concentration and alcoholysis temperature*
   Alcoholysis at 255°C. with 0.01% litharge results in slight haze whereas 255°C.-0.05% causes considerable haze. (See Table 5) In general, a hazy alkyd filters more slowly than a clear alkyd.

Longer filtration times are caused by:

1. Higher alcoholysis temperatures, therefore shorter alcoholysis times.
2. Use of condenser.
3. Low inert gas flow.
4. Lower esterification temperatures.

These conditions would result in less loss of polyol permitting more efficient utilization in the alkyd. As a consequence, the alkyd structure may be somewhat different in one case. Other evidence obtained in our laboratory indicates this to be a reasonable supposition. A more linear alkyd appears to require longer filtration times than does a more highly cross-linked or higher cyclic ester alkyd.

Shorter filtration times result from:

1. Lower alcoholysis temperatures resulting in longer actual times of alcoholysis.
2. No condenser.
3. Extended alcoholysis hold times.

A greater loss of polyol in the above would increase the ratio of phthalic to polyol resulting ultimately in a less linear alkyd.

Summary

To obtain low color with pentaerythritol alkyds the following factors are important:

1. Alcoholysis catalyst concentration.
2. Alcoholysis temperature.
3. Type of alcoholysis catalyst with the particular oil.

Further aids to low resin color include the use of:

1. Addition of ingredients to the cold kettle.
2. Addition of water to the cold ingredients.

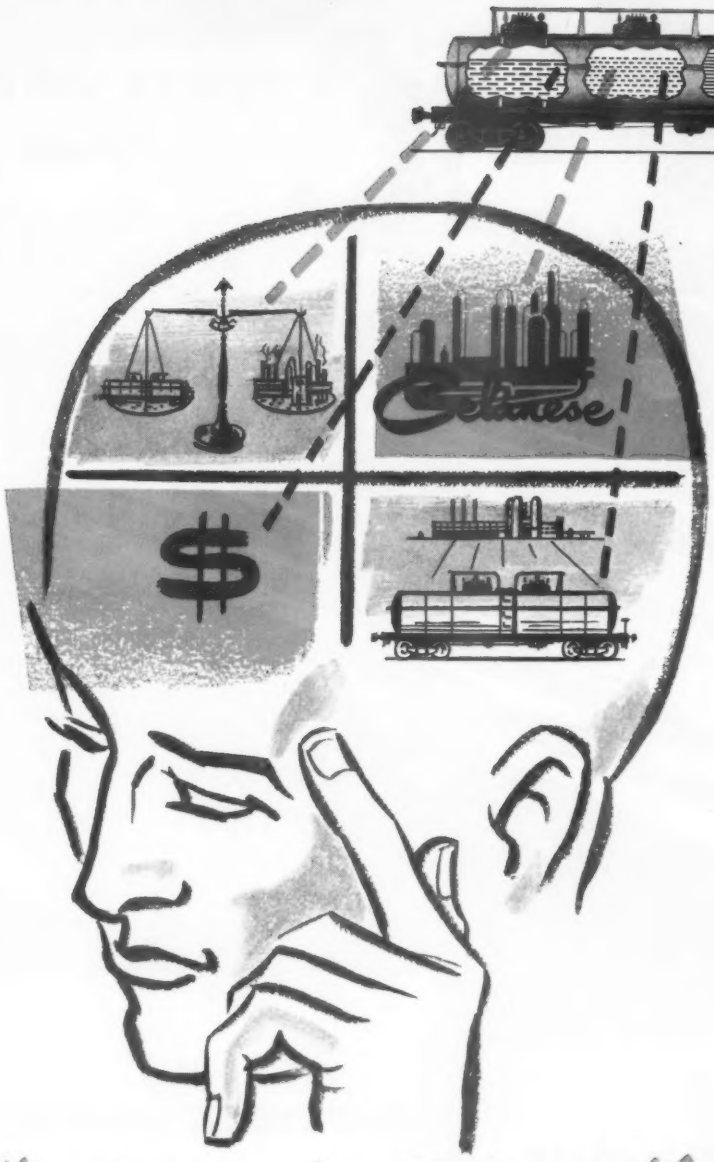
Factors affecting the filtration times of alkyd resins appear to operate through the loss of polyol during processing.

Shorter filtration times are caused by:

1. Lower alcoholysis temperatures.
2. No condenser during alcoholysis.
3. Extended alcoholysis hold times.

Longer filtration times are caused by:

1. Higher alcoholysis temperatures.
2. Use of a condenser during alcoholysis.
3. Low inert gas flow.
4. Lower esterification temperatures.



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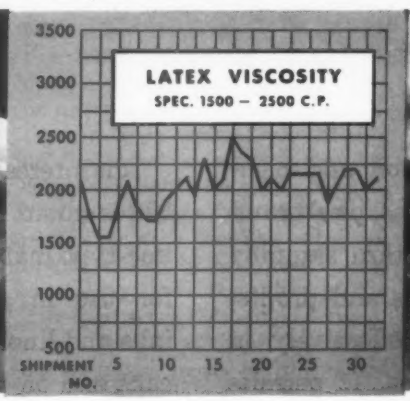

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COATINGS for *Automobile Interiors*

By
M. M. Gerson*

TODAY's automobile has evolved into a complication of materials, mechanics, a styles that could never have been foreseen by that group of rugged mechanical technicians that conceived and created its ancestor. It is not enough for an automobile to run economically, or without trouble; the American public seems to want higher horsepower and more weight.

Nor is it enough to have a car that looks pretty in the showroom. Today's automobile must have exterior style and color and interior style, color, comfort, and durability that will capture the customer's imagination and make him proud of his purchase. We always compliment our friends on their choice of automobile, on their choice of color and interior design, just as we compliment a housewife on the choice of furnishings and colors in her home.

Before the stylists could present these choices of interiors to the public, the materials engineers had to develop materials that could withstand the rigors of automobile service and yet lend themselves to modern mass production methods. How important a consideration are the demands of mass production in this connection, may be inferred from the sewing operation in trim assembly. Sewing needles travel so fast that they become red hot. Certain polymers used in making nylon thread have melted in the needles. Cotton thread had to be continued in use for a long time, regardless of the improved service quality of nylon.

In attempting, then, to analyze the materials needs for the inside of an automobile, we must consider three separate factors:

(1) the service characteristics of the part,

(2) the assembly characteristics of the part,

(3) allowable cost for the part

We must speak in terms of "parts" for the automobile rather than in terms of organic protective coatings, because the prime purpose of the coating is to protect the part. In many cases, particularly the exterior, we build beauty and style into the coating so that the coating is the packaging medium. But the prime requirement of any coating remains that of protection. Its function of style and color is secondary.

It is undoubtedly a great tribute to the coating industry that so much time and money is spent on color and style, and that protection is taken for granted by the customer; just as trouble-free operation is considered a part of each car.

Types of Coatings

There are four kinds of protective coatings on the interior of automobiles:

(1) those which must protect metal, withstand exterior exposure conditions and be decorative, such as coatings for garnish moldings,

(2) those which must be decorative and withstand interior exposure conditions, such as steering column coatings, steering wheel coatings, vacuum metalized plastic coatings, etc.,

*Paint & Chemical Products Plants, Ford Motor Co.
This paper was presented before the Midland, Michigan Coating Society, April 25, 1957.

(3) those which must protect against humidity and corrosive atmospheres but have no decorative function, such as coatings for springs, floors, interior assemblies for doors and windows and

(4) fabric coatings that will permit the use of normal upholstery materials to be used under the abnormal conditions that they will meet in an automobile.

All of the interior coatings that must be decorative have one service characteristic in common; they will be subjected to a common type of abrasion resulting from handling. This may be excessive such as with steering wheels, or garnish moldings; moderate, such as with steering wheel levers and accessory handles; or seldom, such as with dome light door coatings. All of this abrasion is coupled with varying amounts of human perspiration as a complicating factor.

In almost all cases to date, the melamine or urea modified alkyd has been the most successful coating. While this type of coating does not represent the ultimate in any single coating property, its general rating of good in so many coating functions has made it the favorite for this type of coating problem.

It is easy to apply and cure.

It is moderate in cost.

It has good compatibility with all types of pigment combinations.

It is resistant to attack by acids.

Since these coatings are never subjected to moisture saturation by rain or dew, and they do not receive long uninterrupted doses of sunlight, a wider choice of alkyd-amine-aldehyde combinations is available for specific application formulation than is common for exterior coatings.

For the interior coatings of the automobile which must "protect" but are seldom seen, we encounter the "ease of application" and "cost" properties of coatings in a manner that has no parallel any place in industry. To consider this problem properly, we have to think, not as coatings chemists, but as automobile materials engineers and designers. To this group of engineers, the part (such as the window regulator arm, the spring, or the retaining clip), is important. Paint is a necessary evil for prevention of rust and squeaks and to insure proper functioning. Ease of application and curing and low cost, are the predominant considerations. Since accelerated testing requirements are limited to a 24 or 48 hour salt spray exposure, the asphaltics or low solid modified alkyd enamels have dominated this field.

Trim Coatings

We have been talking about organic coatings but until now we have discussed "paints". A new definition for paints, might be organic coatings for use over a rigid substrate. A large and important use in automobiles for organic coatings, is that for trim materials or organic coatings for a flexible substrate. Almost every item of trim material has some type of coating applied. Whether it is vinyl compound over fabric to give us vinyl upholstery (*formerly* known as artificial leather), urea-formaldehyde resins for embossed headlinings, or adhesives to permit di-electric heat sealing, we are still talking about organic coatings.

In both cases, the coating must protect and enhance the service qualities of the substrate (incidentally, it has to adhere to it) and it must protect and enhance the decorative qualities as well.

Most of us in the coatings field are startled each year by the new color combinations of paint selected by the automotive stylists. These are as nothing, compared with the trim patterns and colors that are put together to make an attractive interior for the automobile. Tufted carpets, metallized fabrics, slub grain fabrics, pastel vinyls and white leather are standard trim materials for almost every automobile manufacturer. These are common and useable today because of the advances in their technology, just as pastels are common in exterior automotive paint because of advances in pigment and resin technology.

The amount of fabric coatings needed by the automotive industry has rapidly become an item of big volume. From a matter of 2 to 3 square yards of vinyl coated fabrics for all automobiles in 1950 to 12 square yards in 1956, the use of vinyl compounds on automobiles for fabric coating has begun to approach 45 million pounds per year. Fabrics of all types are used to an extent of about 6 square yards per automobile. At ¾ ounce per square yard of finishing resin, the volume approximates 2,500,000 pounds of this class of resins per year.

Let us look for a moment at the problems of automotive trim to determine what we can use, what we cannot use, and what we must use. The first problem, and one that is so often overlooked, is the ability of a trim item to be used as an engineering material in a mass-production operation. It must be capable of being sewn, stapled, or heat sealed easily and economically; it cannot mar or soil in handling or transit. It must fit well or be capable of shrinking into position to prevent wrinkles.

Its service or durability characteristics must be almost as rugged as if it were designed for continuous outdoor exposure. Trim materials receive extended exposure to ultraviolet radiation, they get wet, if not from rain, then from wet overcoats, and dogs paws; they are subjected to all the industrial fumes of large urban areas; they get covered with road dust; and subjected to abrasion from all types of rough fabrics, brief cases, children's shoes and super-market shopping bags. There are a few more hazards for todays automobile interiors that complicate life; such as drive-in restaurants with ketchup, mustard, and pic-a-lili stains; interior automobile temperatures of 180F or more in Detroit in the summer to −40F in Minnesota or Alberta; and now the tendency to use higher proportions of synthetic fibers in our everyday clothing.

Through all of this, the very strict arbiter of quality standards, the class that purchases more than

80% of today's automobiles, the American woman, wants a clean looking, fresh looking, glamorous automobile. And like all good vendors, we have to give our customers the products that they want.

Vinyls Fill the Bill

The single class of trim materials that have come closest thus far to satisfying all of these needs has been the vinyl coated fabrics. These fabrics represent a blending of a natural material with a synthetic to utilize the optimum properties of both. From the fabrics we obtain tensile and tear strength, stretch and set, and shrinkage. These are the properties that are of primary importance to the trim assembly man. From the vinyl we obtain the abrasion, chemical, non-soiling, and decorative qualities of the fabric that are important to the stylist because they are important to the customer.

The formulation of a vinyl plastic for this purpose may be considered as similar to the formulation of a lacquer coating. The film formers are thermoplastics and must be plasticized, pigments must be dispersed, and the coatings must be easily applied. Two major differences exist, first, the coatings are generally manufactured and applied as part of a continuous operation, and second, viscosity is controlled by temperature instead of solvents.

Two types of coatings are generally used, the plastisol coating and calendered coating. Both depend upon heat for final fusion of the vinyl resin and formation of a homogeneous, flexible film. Since temperatures over 350F are needed, such temperatures may be used for only seconds so as not to damage the cloth backing.

In both cases, the functions of the ingredients are similar. The vinyl resin is chosen with as high a molecular weight as is consistent with processing; the plasticizer for proper flexibility and viscosity under all types of processing and service conditions. The fillers for cost control, proper "hand" or "drape", stabilizers for heat and light stability, and the pigments for color. Lubricants or release agents may be added as necessary, but they must be closely controlled just as driers are. If 1 # of lubricant is good, 2 # is generally twice as much as needed and not twice as good.

The upsurge of vinyl coated fabrics in the automotive industry apparently served as an added stimulant for special treatments of the fiber fabrics. The variety of color, the intricacy of design, the excellent abrasion resistance, and ease of cleaning of vinyls has resulted in a host of new fabrics with mixed yarn content and with new claims for excellence as upholstery fabrics. King cotton has risen and attempted to meet this new challenge. Abrasion resistance, water repellency, soiling, creasing, are the chief problems. Resins familiar to the paint chemist are again the solution. The original treatments were waxes, physically deposited around the yarns. Such treatments are not permanent and must be replaced frequently.

The newer and more successful treatments take advantage of the reactive hydroxyl or carboxyl group in the hexose nucleus of the cellulose chain. Low molecular weight modified urea-formaldehyde, melamine-formaldehyde, and even epoxy resin units are prepared as water solutions or emulsions. These are used in a bath for the fabric after weaving and desizing. In the presence of catalysts or high heat, the resins polymerize and combine with the yarns to become an integral part of the fabric.

The control of properties, such as crease-resistance without stiffness, soil-resistance and lubricity, water-repellency and glaze characteristics can be a coatings chemists dream or nightmare. Polymers and catalysts may be designed to crosslink molecular chains of the fibres, or to react with hydroxyls and not carboxyls or vice versa. The amine-aldehyde may polymerize into a linear or cyclic molecule, all of which will change the "hand", sheen, and water resistance characteristics.

The thermoplastics have been used as well as the thermo-sets for fabric treatment and acrylics, polyvinyl acetates, styrene-butadiene emulsions are not strange names to this field. Their use now is primarily in combination with the thermo-sets to provide the compromise of qualities of "hand" and ease of processing with wrinkle resistance, water and soil resistance.

The ubiquitous alkyd resin maintains its claim for that title by its versatility as a textile printing resin. It is used for pigment dispersion and emulsified for rapid, durable printing of the colorful fabric designs that are so common.

An interesting corollary to the use of paints is evident in the use of coating resins for fabrics. A single type of substrate may be used for many different purposes depending on the coat of paint that it has. Wood painted white is used for houses, red for barns, clear coated for furniture. So are the fabrics, synthetic or natural; nylon, wool, cotton, rayon, and the others, treated with melamine resins for shrinkage or stiffness; urea resins for glaze or abrasion resistance and find their place as bolster fabrics, convertible tops, embossed headlining, or carpets as needed by the automotive industry.

These are the materials of construction; now what shall we construct. Leaving color and design pattern to the stylist, the coatings chemist has these problems all to himself whether the fabric is vinyl coated, natural fiber, or synthetic fiber fabrics:—the problems of improved slideability, improved soil resistance, improved "hand or feel" at all temperatures, and as always improved cost. Whether that improvement in cost is made by easier processing or lower raw material cost is not necessarily significant. Just as in paints, it is the cost of the final finished product that is important to the consumer.

How far do we want to go in our formulations and in our development. The ultimate authority has a ready answer. . . .we just have to ask him. What will it take to satisfy *you*, when you buy your new automobile; or what will it take to satisfy your wife. Or the ultimate of ultimates, what does it take to get the teen-ager to say, "this is a cool car". When we have the permanent answer to this question, we will have completed our work as coatings chemists and we will have nothing left to do but spend all of our time riding in our "cool cars".

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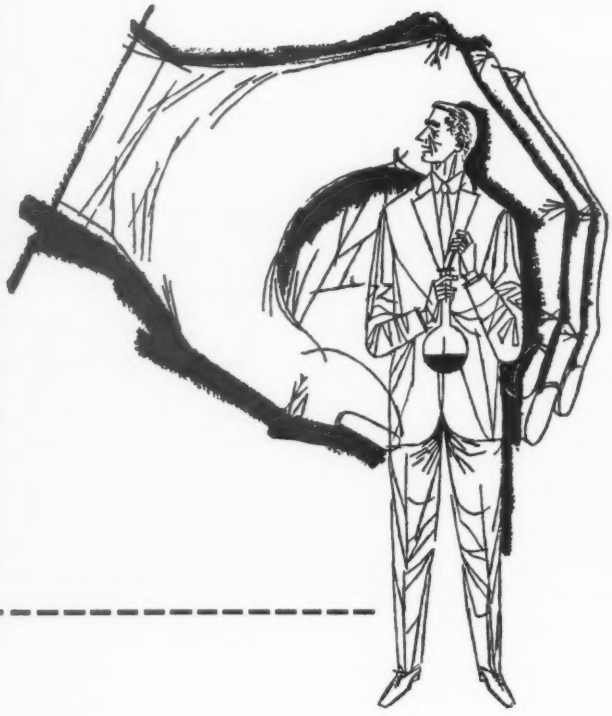

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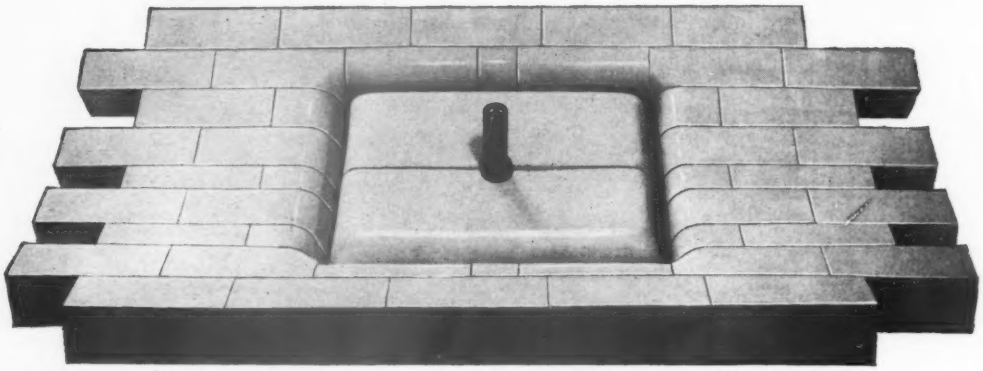

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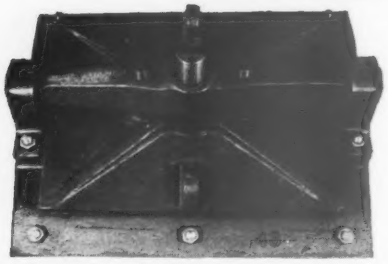

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Control of Frictional Electrification Improves—

ELECTROSTATIC APPLICATION OF POLYCHROMATIC COATINGS

By
George E. F. Brewer*

Frictional electrification accompanies the atomization of commercially used paint compositions when sprayed from conventional hand spray guns. In general, electrification was found to vary from positive 1 x 10^{-8} amperes to negative 1 x 10^{-8} amperes, or more. The equipment for the measurement of the electrification is described.

It was found that electrification of the average atomized paint particle can be increased or decreased through the use of properly formulated thinners. Some examples of satisfactory thinners are given.

The electrification of paint spray was found to be correlated to the distribution of the metallic effect in electrostatically applied polychromatic paints. It was found that the metallic effect is more evenly distributed when the frictional electrification of the spray is at a minimum.

In some unusual cases the size of the frictional electrification depended upon the sequence in which the components of the thinner were added. Thus, two or more paints of identical chemical composition result in different frictional electric properties and performance. Samples of the resulting electrostatically sprayed polychromatic coatings are shown.

IT is well known that the mechanical agitation of liquids produces frictional electrification. It is to be expected that electric phenomena will accompany that type of agitation which results in the formation of a spray. Indeed, water forms a mist of electrically charged droplets[4] and it is known that the electrification of water is influenced by dissolved salts.[3] The frictional electricity generated on agitation of mixtures of organic liquids was studied recently.[1] It was observed that the frictional electricity generated on agitation of mixtures goes through one or more maxima and/or minima as the relative ratio of the components is varied. In certain cases addition of some liquid diminishes the frictional electrification toward zero and further increase in the concentration of this component produces charges of the opposite polarity. It is, therefore, possible to blend organic liquids so that they produce on agitation, larger or smaller amounts of positive or negative charges, or no charge at all.

Recently it has been found that the deposition of colloidal graphite from suspension in organic liquids onto textile surfaces is in direct proportion to the frictional electricity generated on agitation.[2]

These experiments were interpreted to indicate that different suspended solids may be influenced by the presence or absence of frictional electrification. Frictional electric phenomena may, therefore, influence the application of surface coatings and the present paper deals with certain findings made on polychromatic paint compositions.

Measuring Electrification

Gun

A De Vilbiss external mixing gun (CM 501) with a No. 39E nozzle was used. A 250 ml Pyrex Griffin low form beaker was used as paint pot. The paint entered directly at the fluid inlet nipple (PCM 104). Thus, the paint level was at no time more than 1¼ inch or less than 1 inch below the gun's orifice. (See Figure 1) 30 p.s.i. air pressure was used in all experiments.

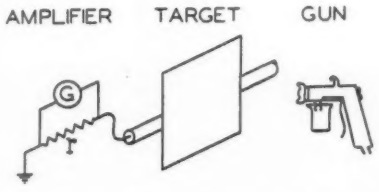


Figure 1. Spraying method set-up.

Target

A 12 by 12 inch stainless steel plate was bolted to a styrene tube. Inserted in the bore of the styrene was a coaxial cable which connected the target with an electronic amplifier. It is expedient to cover the target with a thin metal foil, which is disposable and should be renewed frequently. The dis-

*Gage Products Co., Ferndale, Mich.

Presented at the 130th meeting of American Chemical Society, Division of Paint Plastics and Printing Ink Chemistry, Atlantic City, New Jersey, September 1956.

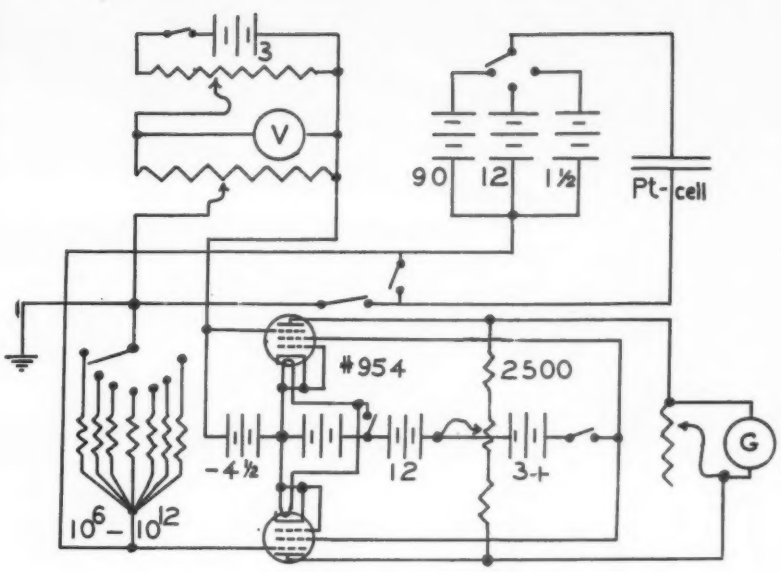


Figure 2. Push-Pull Amplifier

tance between the gun's orifice and the target was 20 inches.

Amplifier

A push-pull, low amperage-high voltage amplifier with "954" tubes and S. S. White molded resistors was used. In conjunction with a potentiometer and resistance cell, the circuit, shown in Figure 2, allows the measurement of resistances and voltages. In the present study the amperage flowing between target and ground was computed from the potential drop over a suitable standard resistor, "r" (chosen between 10^6 and 10^{12} ohm).

Experiments and Discussion

Typical paint samples were received from paint departments of various consumers, who had thinned these paints to 15± 1 sec. #4 Ford Cup.

"−" (negative) means excess electrons flowing from spray through target towards ground.

"+" (positive) means electron deficiency of spray.

PAINT	10^{-11} Amp.
"A"	−12.5
"B"	+68
"C"	+170
"D"	−76

Table I. Observed electrification on spraying.

Various solvents were added to these samples and the frictional electricity generated on spraying was markedly affected. Typical examples are shown in Table II.

The paints "A" through "D" were chosen to illustrate that a given chemical (for instance n-butanol) may affect different paints in different ways. No correlation between this behavior and the paint composition has been established as yet. We attribute this, not only to the nature or blend of paint vehicles, pigments, etc., but also to small additions of thinning media or other variations during the manufacturing process.

Our attention was then turned towards the practical consequences which an increase or decrease in frictional electrification may have. It was observed that best results are obtained on commercial electrostatic spraying when the spray electrification was at a minimum. Of course, it is necessary to blend paints so that a minimum of spray electrification coincides with a particular viscosity and other desirable properties.

We observed that the addition of some hydrocarbons did not affect the spray electrification of certain paints. This fact offers the possibility to thin a given paint in two steps: First, reach a minimum of spray electrification through the addition of liquid chemicals and then thin the paint in the usual way to the desired viscosity. As an example a polychromatic paint "E" may serve. In this case many solvents produced minima of spray electrification, yet, due to the desired drying time, flow out, gloss, etc., a mixture of 25 vol. % n-butanol, 25 vol. % ethylene-glycol-n-butylether and 50 vol. % hexylene glycol was chosen as chemical additive to reduce the spray electrification, while a hydrocarbon blend (E-407, Shell Oil Co.) was used as thinner (see Table III).

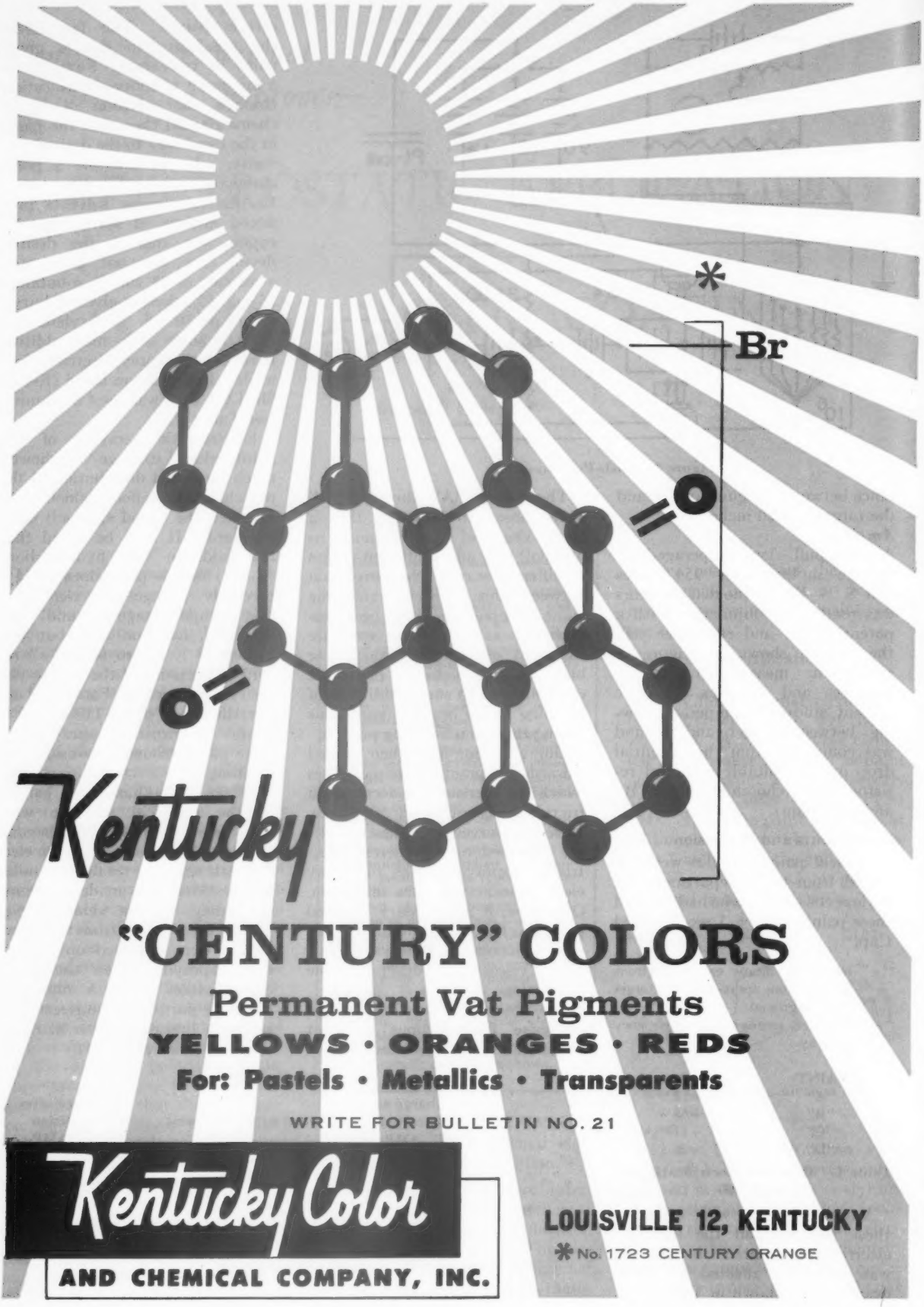
Electrostatic spraying of the paint reduced to stage "d" showed much improved distribution of the polychromatic effect which now matched the (hand sprayed) color standard. It may be noted that the addition of hydrocarbons (E-407) to this paint does not appreciably change the electrification (compare stage "b" and "d"). Similarly, addition of about two gallons of E-407 to stage "a" resulted in a paint of the proper viscosity 16.0 sec. #4 Ford) and an electrification of -2.0×10^{-11} Amp. Electrostatic spraying of this paint showed considerable mottling.

When more than three gallons of the chemical additive were used (continued addition beyond stage "b") color separation on electrostatic spraying resulted. Similar observations were made on paints containing various vehicles, pigments, etc. In all cases optimum results were obtained on electrostatic spraying when the spray electrification was at a minimum. We were particularly interested to see, in a limited number of cases,

(*Turn to page 96*)

PAINT	Charge as Received 10^{-11} AMP.	Added to 100 ml Paint	Charge after Addition 10^{-11} AMP.
"A"	−12.5	15 ml n-butanol	− 3.4
	−12.5	5 ml n-butyl acetate	−16.5
"B"	+68	25 ml n-butanol	+68
	+68	25 ml diacetone alcohol	+17
"C"	+170	10 ml n-butanol	+255
"D"	−76	10 ml n-butanol	−84

Table II. Examples of the influence of addition of thinners to paints.



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Dr. W. B. Maass

PAINT INDUSTRY Shows Rapid Advance In Post-War Europe

By
Dr. Walter B. Maass
Technical Director
Industrial Finishes Division
Adelphi Paint & Color Works

THE paint chemist, visiting factories and talking to paint executives while travelling through Europe, naturally makes a number of observations. His first and perhaps most important impression is that Europe and its industry are changing.

There is a new spirit and a new approach. The old, old idea of a united, or federated, Europe is gaining strength. There is much discussion regarding "Little Europe"—the planned integration of France, Belgium, Holland, Luxemburg, Italy, and West Germany. If this becomes a fact, and all signs indicate that it will, we might witness a development of truly historical dimensions.

Overlooking the little town of Locarno, Switzerland, from a nearby mountain top, one is reminded that it was here that Briand and Stresemann tried to reach a lasting compromise in 1925. Something of this spirit now seems to be in the air. Will Western Europe become an economical unit during the next decade? If so, we will see great changes which might well influence our own economy.

So far, however, Europe west of the Soviet border is still divided into many economical spheres. If one examines a part of its business life, for example the paint industry, one must understand that conditions and methods in different countries still vary to a considerable degree.

Let us take a look at the Netherlands. The achievements of the paint industry in that small country are truly impressive. Twenty per cent of Holland's paint products are made for export, a greater portion than those of any other nation. Holland has the oldest, and at the same time perhaps the most progressive, paint industry of the world.

Technical development after World War II has been rapid and intense. Large, modern synthetic resin plants supply the domestic market and engage in a thriving export business. Much work has been done on epoxy resins, cyclized rubber and emulsion paints.

The writer visited Austria's largest machinery plant, where epoxy coatings of Dutch origin were applied to huge oil pumps. The quality of primer and finish, both catalyzed and baked under infrared lamps, was of the highest.

As in Great Britain, so-called "Zinc-rich Paints" have gained importance in Holland. These paints consist of 94-95 per cent zinc dust, dispersed in a fast drying vehicle (polystyrene resin, chlorinated or cyclized rubber). The heavy body paints provide excellent anodic protection.

In Holland, the Institute for the Application of Zinc has done much to make these paints more popular, while in England, the Iron and Steel Institute has engaged in research work of a similar nature.

The Swiss Railroads, traditionally very quality minded, are using the "Zinc-rich" paints, and they may also become important in the shipbuilding field.

Cyclized rubber is made in Holland, England, and Germany. In contrast to chlorinated rubber, it is soluble in aliphatic hydrocarbons and compatible with alkyd resins of long and medium oil length. This rubber resin differs somewhat from our Pliolite, but like the latter, its value is mainly as a base for chemically resistant coatings.

The remarkable reconstruction job done by the Dutch since 1945 has naturally helped the paint industry. Evidence of the great devastation of World War II has entirely disappeared. A visit at Arnhem, scene of the savage battle in September, 1944, makes this quite clear. Not a sign of the vast damage remains!

Rotterdam and The Hague, which

suffered so severely from air bombardments, have been beautifully rebuilt. The many new office and apartment buildings are constructed in excellent taste and are well painted. A modern "flat gebouw" (apartment building) in Rijswijk, a suburb of The Hague, compares favorably with the very best of its type in the United States.

Holland used to be the country on bicycle, but it is quickly becoming motorized. British and German cars, as well as Fords assembled in Amsterdam, are abundant. The bicycle is being replaced by the motorbike and the scooter.

It is interesting to note that some paint manufacturers seem to be anticipating the unification of Western Europe, and are pooling their resources. They are streamlining their research and combining their efforts to widen markets.

One such group of four companies has factories in Holland, France, Italy and Switzerland. The companies hold regular meetings, where key personnel discuss all questions of mutual interest. They maintain a research fund under the direction of a coordinator, who makes his office at The Hague. The group has demonstrated that medium sized paint firms can cooperate without giving up their independence.

The writer visited one of the companies in Zurich and was impressed by the cleanliness and quiet efficiency of the plant. It contrasted sharply with the plainness and dingy appearances of so many paint factories in the United States and elsewhere.

The sales manager of the firm had recently visited the United States as a member of a study group of paint executives. It was interesting to discuss his experiences with him. It was his opinion that formulation and methods of production are about on the same level in the United States as in Switzerland. He was deeply impressed, however, with American market research and sales management. He praised the spirit of fair play in American competition, and felt that our paint industry is doing a wonderful job of bringing its products to the public.

He particularly mentioned the "Do it Yourself" market. It seems that we in America have really been pioneers in opening that market to the paint manufacturer. Paint manufacturers in other countries are now following by concentrating their efforts on the man who uses paints in his home. In Switzerland, where many people own their own homes, the movement is rapidly gaining momentum.

Interestingly, there are very few paint stores in Switzerland. A large section of the public buys its paints in drug stores.

While Switzerland probably has the highest standard of living in Europe, its neighbor, Austria, has only recently recovered from the disasters of war and 18 years of occupation. Vienna ceased long ago to be a city of glamor, but much of its old beauty has been restored. It is now a place where one can admire beautiful stores and enjoy excellent and inexpensive food.

Less enchanting is the poor state of most older apartment houses. Rent control is so strict that landlords get hardly any return on their investments. The result is that many houses have been neglected and are now in dire need of a good coat of paint.

There is certainly no shortage of paint factories. Approximately 50 plants are in operation, and many of the larger paint stores make their own oil paint. Noteworthy also is the fact that the organization of Austrian painters maintains a well-equipped paint factory to supply its members, very much to the displeasure of many dealers.

The writer had the opportunity of speaking before a group of Austrian paint dealers. He was told that the market for emulsion paints was still quite limited. Oleoresinous and alkyd paints dominate the field. Tube systems are not being sold so far.

When one discusses formulation, one must always remember that the European paint manufacturer sells by weight—in kilogram—not by volume. He is, therefore, little concerned with the bulk of his paint. It follows that a cheap paint will usually have a high specific gravity.

For that reason barytes still occupy an important place among the functional pigments. Because of the wide differences in specific gravity, the European paint maker is forced to stock a greater variety of containers than his American counterpart. A can for one kilogram of red lead in oil will obviously be quite different from a one kilogram can for clear furniture lacquer.

The larger containers are generally returned to the paint manufacturer, who cleans them and uses them again. Most paint factories have a cleaning department, where empty cans are processed with caustic soda or trisodium phosphate, a cumbersome procedure. Such an operation would be unprofitable in the United States, but we have to remember that labor costs in most European countries are lower than in America.

Another typically European phenomenon is that even small paint plants manufacture a great variety of products. It is not unusual to find paint factories including rust inhibitors, floor waxes, weed killers and other chemical compounds in their manufacturing lines.

Serving a smaller market, paint manufacturers are forced to branch out in many directions, and complete specialization is rare. Most larger plants cook their own varnishes, often also their own alkyd resins. Chemists have to be very versatile, and cannot afford to become onesided.

An interesting raw material has come from behind the Iron Curtain. It is a red-brown bauxite, found in Hungary, sold under the name of "Alu-Red." It consists mainly of aluminum oxide and iron oxide, and seems to have considerable merit as an inexpensive pigment in rust inhibitive coatings. Primers based on "Alu-Red," zinc chromate and an alkyd resin of medium oil length, are competing against the traditional red lead paints.

Generally speaking, zinc chromate, originally an American development, is now gaining in popularity throughout the continent. Polyurethane resins, made in Germany, are being investigated by European paint chemists. These resins originally were received with reservations because of their toxic character. Non-toxic types are now appearing, however, and are creating a great deal of interest.

(Turn to page 91)

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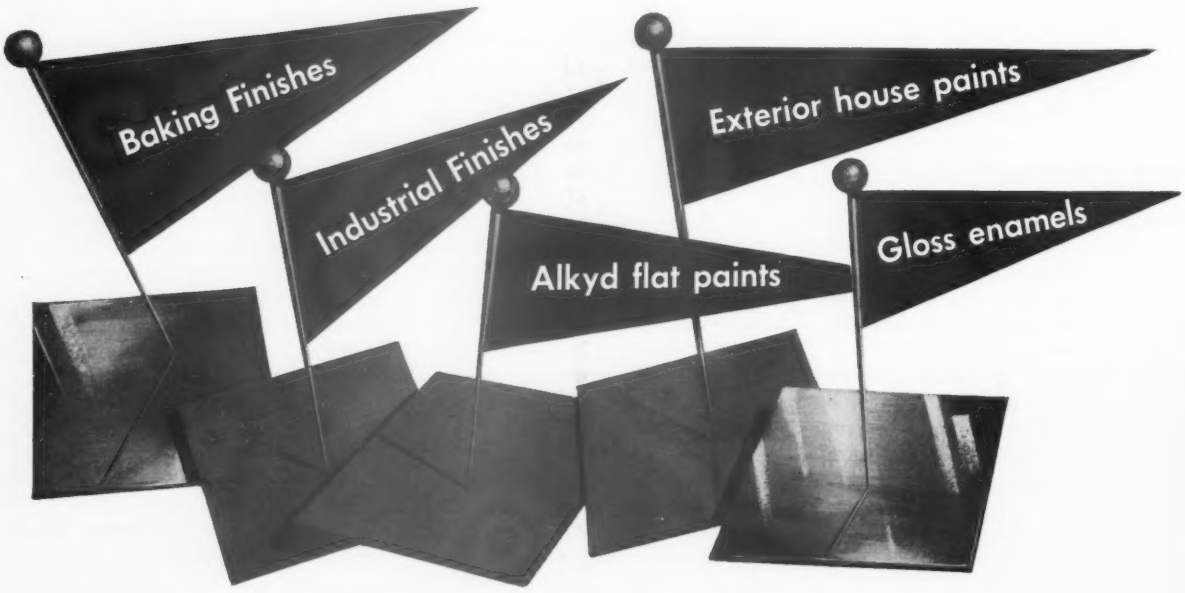

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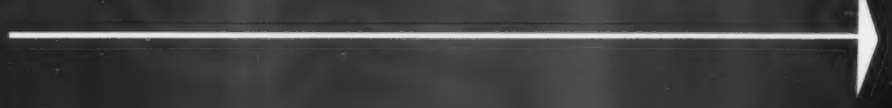

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STATISTICAL ANALYSIS in a POLYMERIZATION PROCESS

By
Louis A. Pastellnick*
and
William B. Leder*

A PROCESS study carried out in the manufacturing plant differs from a laboratory or pilot plant experiment. In investigating the polymerization process described in this paper the criteria used to decide upon the variables to be investigated were different from those the laboratory scientist would select.

There are several criteria that the manufacturing engineer can use to help him decide on the variables to be studied in the plant. One is whether the variable can be controlled without major changes in plant operating equipment. As an example, in the experiment described here it was known that polymerization temperature variation would affect the product, but costly changes in plant operating equipment would have been needed to better control the temperature. This variable was relegated to the laboratory for investigation.

The plant experiment should take place with the minimum curtailment of production schedules. Those variables which might affect product quality severely enough to cause the production of a large amount of out of specification product should be investigated in the laboratory. The cost of plant scale experimentation heightens the need for efficient experimental design, running the fewest experiments to gain the desired information.

Process Description

The polymerization process uses a fluorocarbon monomer as a starting material. This freshly made monomer is mixed with recycle monomer from the polymerization section and purified. The purified monomer is stored and used as the manufacturing process requires. See Figure 1.

Monomer and catalyst are charged to the reaction vessels and the polymerization is allowed to proceed. Unreacted or recycle monomer is recovered and the polymer product is transferred from the reaction vessel to driers. The dried polymer is weighed, sampled and evaluated. Recycle monomer carries with it certain by-products of the process, some of which may be contaminants. The recycle monomer is purified for reuse.

Experiment

The experiment was designed to answer the question of whether the ratio of fresh to recycle monomer in monomer blends affected the polymerization conversion or any of the product qualities. The blend ratios used in the experiment were at the extremes of probable plant operating conditions.

The second factor whose effect was investigated was the level of catalyst concentration in the monomer at the start of polymerization. Variations in the catalyst concentration over a broad range do affect the conversion and the molecular weight of the product. Since the product molecular weight specifications are narrow, the catalyst concentration variation was held within a small range. The plant operating concentration was placed at the center point and the experimental catalyst concentrations were placed on both sides of the standard level. The effects of this variable as well as the other one studied were measured by two responses, conversion and a measure of the apparent molecular weight of the polymer, ZST.

Because of the relatively narrow range over which one can usually manipulate the independent variables, the magnitude of the responses may be small. It is, there-

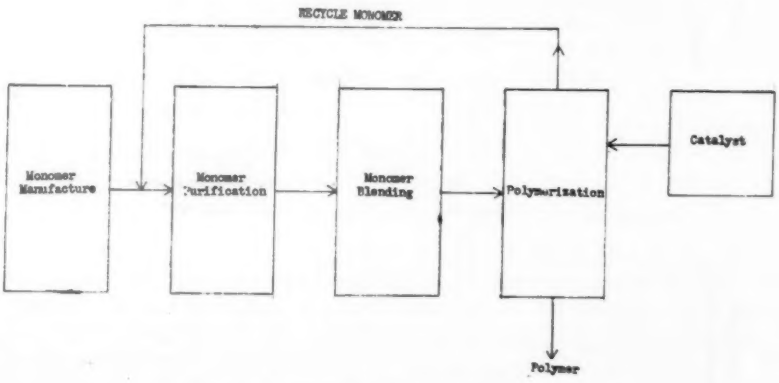


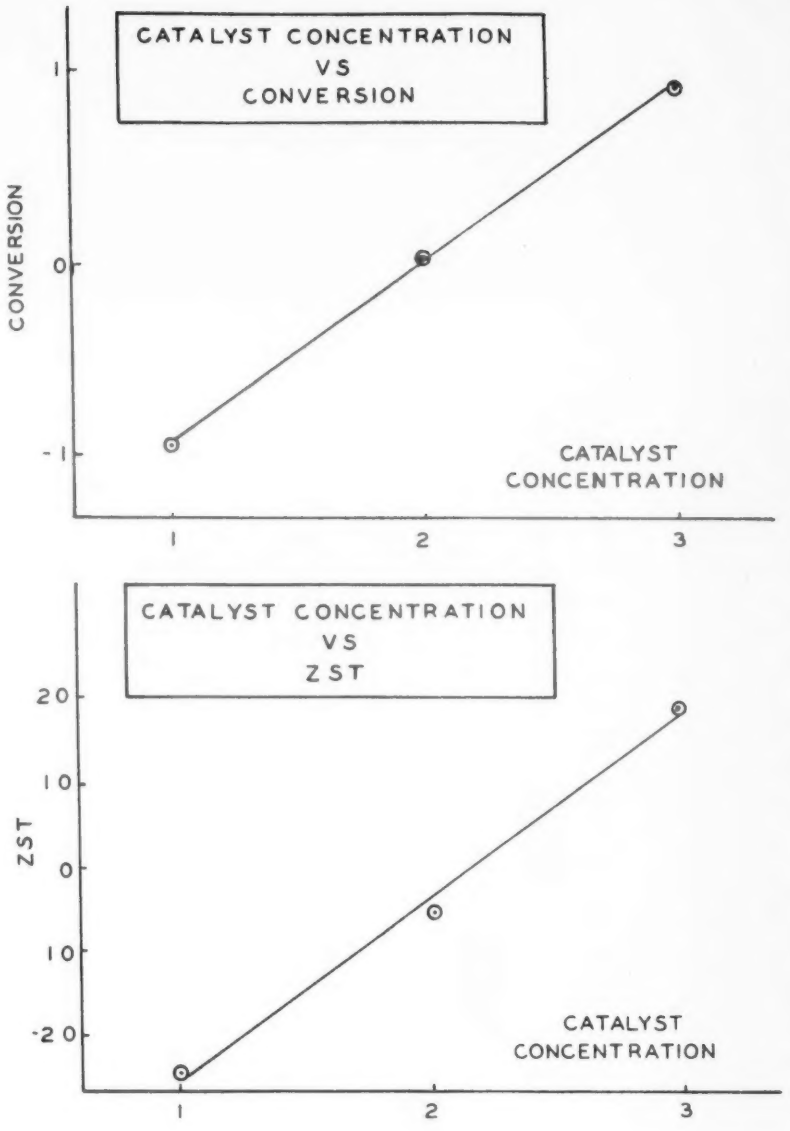
Figure 1. Polymerization Process Flow Diagram

*Messers Pastellnick and Leder are associated with the M. W. Kellogg Co. This paper was presented at the symposium on Statistical Methods in the Chemical Industry sponsored by the Metropolitan and Chemical Div. of the American Society for Quality Control and Stevens Institute of Technology, which was held at Stevens Institute of Technology, Hoboken, N. J. on January 12, 1957.

Catalyst Concentration		Blend Ratio I		Blend Ratio 2	
		Conversion	ZST	Conversion	ZST
		- 4.2	- 15	1.7	2
		0.5	2	- 3.6	- 8
		- 2.3	1	0.4	8
1		- 2.4	- 6	0.7	- 4
		- 0.9	1	- 0.9	- 2
		- 1.1	- 2	- 3.3	- 11
		- 1.1	1	3.2	0
	Σx	-11.5	- 18	- 1.8	- 15
	Σx^2	32.17	272	38.44	273
		- 0.9	0	- 0.7	- 4
		0.4	0	- 0.7	0
		0.0	1	- 0.3	- 2
2		0.3	6	0.4	- 1
		- 2.9	- 4	0.3	- 3
		1.1	2	1.7	2
		2.1	3	- 0.1	7
	Σx	- 0.1	8	0.6	- 15
	Σx^2	15.09	66	4.22	83
		1.4	7	0.1	2
		0.7	1	0.6	0
		1.6	6	- 2.3	6
3		2.7	6	1.6	- 2
		1.2	0	3.2	- 1
		1.3	3	- 3.5	- 9
		0.3	- 2	3.9	10
	Σx	9.2	21	3.6	6
	Σx^2	15.2	135	45.92	226

Above: Table I. Results obtained in the experiment for conversion and ZST

Right: Figure 2. Plot of the data for conversion and ZST



fore, necessary to replicate or repeat the experiment. If an estimate of the process variance is available from previous data then the number of replications needed for a given confidence in the conclusions can be calculated.

Seven polymerizations were run at each monomer catalyst condition according to the following plan:

	Catalyst Concentration		
Blend Ratio	1	2	3
1	7	7	7
2	7	7	7

The results obtained in this experiment for conversion and ZST are presented in Table I. From our knowledge of the process, two of the original data values were judged to be spurious. For those two values that were judged out of line, the average value of the subgroup in which each occurred was substituted and the degree of freedom associated with each adjusted value subtracted from the total degrees of freedom in the analysis of variance (1). By this method the residual variance is minimized and allows completion of the analysis as though the original data were balanced. An estimate of the standard deviation was obtained by computing the range of each subgroup of seven, finding the average range and dividing by the appropriate d_2 factor (2). The estimates of standard deviation obtained were 1.3 units of conversion and 49 units of ZST. Since it is generally safe to round data to one quarter of the standard deviation (3), the values for ZST were rounded to the nearest 10 units. No savings in computation time would have been obtained by rounding the conversion data. To further aid in simplifying the analysis, the data were coded by subtracting the grand average from each value. In the case of the ZST data each value was also divided by ten. Subtracting a constant from each value has no effect on the variation, dividing individual values by a constant has the effect of dividing the estimates of variance by the constant squared. The data in Table I are the coded and rounded values.

The details of the analysis of variance for conversion are shown in Table II. The numbers in the six boxes represent the algebraic total of the seven values of the particular combination of blend ratio and catalyst concentration. ΣX^2 represents the sum of the squares of each of the 42 data values. A description of the calculations for the general case in an analysis of variance of this type can be found in references (1), (4) or (5).

(*Turn to page 92*)

	Catalyst Concentration			
Blend Ratio	1	2	3	Row Totals
1	-11.5	-0.1	9.2	-2.4
2	- 1.8	0.6	3.6	2.4
Column Totals	-13.3	0.5	12.8	0.0

$$\text{Correction Term} = \frac{(\Sigma X_i)^2}{N} = \frac{(0)^2}{42} = 0$$

$$\text{Total Sum of Squares} = \Sigma X_i^2 - C.T. = 151.36$$

$$\text{Sum of Squares for Blend Ratio} = \frac{(-2.4)^2 + (2.4)^2}{21} = 0.55$$

Sum of Squares for Catalyst Concentration

$$\frac{(-13.3)^2 + (0.5)^2 + (12.8)^2}{14} = 24.36$$

Sum of Square for Catalyst Concentration X Blend Ratio Interaction

$$\frac{(-11.5)^2 + (-0.1)^2 + (9.2)^2 + (-1.8)^2 + (0.6)^2 + (3.6)^2}{7} - (0.55 + 24.36) = 8.44$$

The 2 degrees of freedom associated with catalyst concentration have been partitioned (5) as follows:

A. For Linear Term

Linear Coefficients	Column Totals	Products of Coefficients and Column Totals
1	13.3	-13.3
0	0.5	0.0
-1	12.8	-12.8
		-26.1

$$\text{Mean Square for Linear Term} = \frac{(-26.1)^2}{14\left[(1)^2 + (-1)^2\right]} = 24.33$$

B. For Quadratic Term

Quadratic Coefficients	Column Totals	Products of Coefficients and Column Totals
-1	-13.3	13.3
2	0.5	1.0
-1	12.8	-12.8
		1.5

$$\text{Mean Square for Quadratic Term} = \frac{(1.5)^2}{14\left[(-1)^2 + (2)^2 + (-1)^2\right]} = 0.03$$

Source of Variation	Degrees of Freedom	Sum of Squares	Mean Square	F	F .05
Blend Ratio	1	.55	.55	.16	4.1
Catalyst Concentration					
Linear Term	1	24.33	24.33	7.01	4.1
Quadratic Term	1	.03	.03	.01	4.1
Interaction	2	8.44	4.22	1.22	3.2
Error	34	118.01	3.47		
Total	39	151.36			

$$\text{Slope of conversion line} = \frac{1}{(14)(2)}\left[12.8 - (-13.3)\right] = 0.93 \frac{\text{units}}{\text{catalyst increment}}$$

$$\hat{\sigma}_{\text{slope}} = \left[\frac{3.47}{28}\right]^{1/2} = 0.352 \qquad (1)$$

95% confidence range of slope $= \pm \hat{\sigma}_{\text{slope}} \, t_{(.05,34)}$

$= \pm (.352)(2.03) = \pm 0.72$

95% confidence interval: 0.21 to 1.65

Table II. Details of the analysis of variance for conversion.

NEWS

Color Dispenser Developed

A new color dispensing machine developed by the Martin-Senour Paint Co. has brought automation into the neighborhood paint and department store.

With the aid of the new machine a paint buyer can select any color he wants, insert a card into an automated reader, and have the exact selected color mixed and ready to take home within a few seconds.

William M. Stuart, president of the Martin-Senour Paint Co., views the Colorobot.

The machine, called "Colorobot," assures the paint dealer a full range of color with a relatively small inventory and investment, according to William M. Stuart, Martin-Senour president.

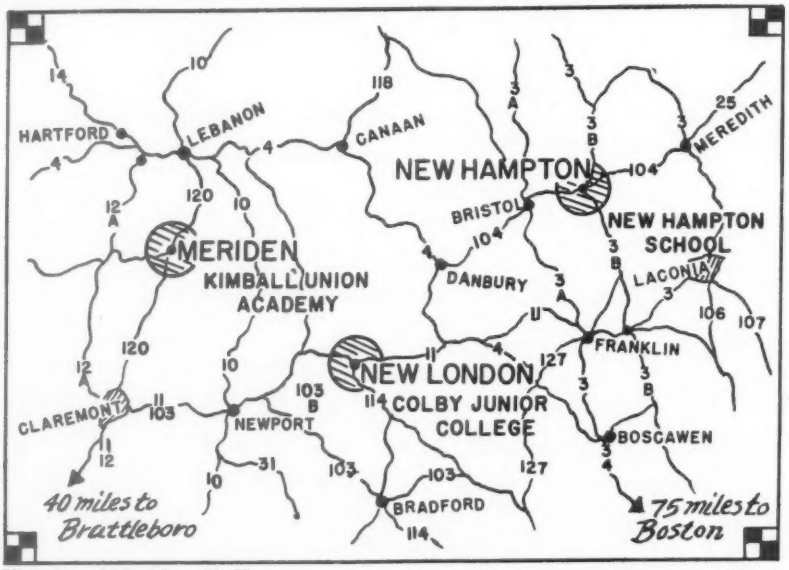
Occupying less than 2½ by 4½ feet, the Colorobot meters out eight colorants through a central delivery point in units less than a cubic centimeter. The machine permits color modifications with as many as three colorants in any given formula.

The Colorobot was created though the combined efforts of industrial designer Morton Goldsholl of Chicago, the Arthur G. Russell Co. of Forestville, Conn., and the Martin-Senour Co. The machine was designed to deliver colors developed under a new system by the company's color consultant, Carl E. Foss.

Gordon Coatings Confab Set for August 19-23

The Organic Coatings Conference of the Gordon Research Conferences for 1957 has been scheduled for August 19-23 at Kimball Union Academy, Meriden, N. H.

The Gordon Research Conferences were established to stimulate research in universities, research foundations and industrial laboratories, through informal lectures and discussion groups. The entire program runs from June 10 to August 30.



Vicinity of Meriden, N. H. (Map Courtesy of *Chemical and Engineering News.*)

Chairman for this year's conference in Organic Coatings is E. G. Bobalek of Case Institute of Technology. E. R. Mueller is co-chairman. The program follows:

August 19: C. W. Gary, Resin Forming Reactions of New Diepoxides. D. F. Koenecke, Some Applications of Reflectance Infrared Methods in Coatings Research.

August 20: N. M. Wiederhorn, Special Aspects of the Chemistry of Soluble Nylons. W. W. Reynolds, Solubility Factors Which Influence the Properties of Alkyd Solutions.

August 21: A. H. Loranger, Syntheses and Evaluation of Uniform Particle Size Latexes. J. F. Vitkuske, Recent Developments in the Mechanism of Emulsion Polymerization. G. L. Brown, Formulation of Films from Polymer Dispersions.

August 22: R. J. Wirshing, A New Approach to the Study of the Degradation of Organic Films. Second topic and speakers to be announced.

August 23: L. R. Brantley, Morphology and Rheology of Organic Coatings from Adherometer Adhesion Measurements.

Information on housing and registration for the conferences may be obtained from W. George Parks, Colby Junior College, New London, N. H.

Knaggs Gets Honorary LL.D.

Nelson S. Knaggs, vice president in charge of sales of the Hilton-Davis Chemical Co., has been selected to receive the honorary degree of doctor of laws from Davis and Elkins College, Elkins, W. Va.

Mr. Knaggs, a former student of the college, was honored as an outstanding explorer and author who has traveled extensively in 21 countries of Latin America, Nepal and the Near and Far East.

Mr. Knaggs joined the Hilton-Davis firm in 1933 as a research chemist, and later became director of its foreign division. He was elected vice president in 1948.

A member of the Explorers' Club and vice president of the Cincinnati Museum of Natural History, Mr. Knaggs began exploring in 1941. His book, "Adventures in Man's First Plastic," based on his early trips, was included in the 1947 list of the world's best 100 books.

NEWS

Hercules Continues Grants

Hercules Powder Co. has continued its grants-in-aid program for the second year with a total of approximately $100,000 being distributed among some 26 colleges and universities.

When the program was launched last year the company gave $95,000 to 23 schools for unrestricted use.

The program for unrestricted aid enables the schools to use the funds for whatever purpose they choose. The unrestricted grants are made in addition to grants of various kinds by Hercules for specific purposes.

Purpose of the program, according to Hercules president and board chairman, A. E. Forster, is to "encourage American colleges and universities to provide more and better technically trained personnel so vitally needed by industry and by our nation as a whole."

Ten grants went to chemistry departments, 12 to chemical engineering, three to mechanical engineering, and one each to schools of mining engineering and business administration. Recipients are selected from year to year on a cyclic basis in order to distribute funds available to the greatest number of schools and departments.

Suggested uses for the grants include the purchase of special equipment, travel expenses for faculty and research staff members' attendance of technical meetings, stipends for visiting lecturers, grants for summer studies and grants to graduate students for completion of studies in emergency situations.

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To Handle Meta-San

The appointment of Harwood J. Cranston to handle sales of Meta-San has been announced by R. J. Fallon, assistant sales manager of Metalsalts Corp. The product is a low-cost bactericide-fungicide for use in organic coatings.

Mr. Cranston will cover western Pennsylvania, eastern Ohio, and northern West Virginia.

Rutgers Names Winners Of Paint Course Awards

Rutgers University has announced the winners of the Nuodex Products Co. Awards to the highest ranking students in the Paint Technology classes.

William B. Horback, resin chemist for Celanese, is the winner of the first prize in the class in "Advanced Principles of Paint Technology," while John Kowalski, chemist in sales service for Archer-Daniels-Midland, is the second prize winner.

First prize was *Protective and Decorative Coatings*, Vol. 5, by Mattielo, and second prize was *Organic Protective Coatings* by Von Fischer and Bobalek.

First prize winner in the "Introductory Principles of Paint Technology" class was Robert B. Henly, salesman for Pennsylvania Industrial Chemical Corp. Second prize was won by Ranko M. Francis, laboratory assistant for Subox, Inc.

Mr. Henly's award was *Vinyl and Related Polymers* by Schildknecht, and Mr. Francis' was *Organic Protective Coatings.*

The awards were presented by Walter M. Clark, manager of the Paint and Varnish Division of Nuodex in Elizabeth. The presentation took place at the University's Newark Extension Division.

William Lawrence, technical director of trade sales for Flood and Conklin and instructor for both classes, said that the courses would be re-offered next year because of the high enrollment this year. In addition, he said, an advanced course in "Laboratory Techniques" would be offered next year.

Left to right Nuodex prize winners Ranko M. Francis and John Kowalski watch Walter B. Clark, manager of the Nuodex Paint and Varnish Division, present one of the awards to Robert B. Henly. Also looking on are prize winner William B. Horback and Benjamin Chatzinoff, technical director of 20th Century Paint Co., who was guest lecturer at the presentation ceremony. William Lawrence, instructor for the Rutgers paint courses, is at center.

New ASTM Officers

New officers for the American Society for Testing Materials have been named for the coming year. Official announcement was made at the 60th Annual Meeting of the Society in June at Atlantic City.

Richard T. Kropf, vice president and director of research for Belding Heminway Co., Inc., director of activities of the industrial thread division and vice president and general manager of Belding Corticelli Industries, Inc., has been elected ASTM president. He will serve a one year term.

F. L. LaQue, vice president and manager of the development and research division of the International Nickel Co., Inc., is the new ASTM vice president, and will serve for a term of two years.

The following were elected to serve three-year terms as directors of the Society: Claude L. Clark, Timkin Roller Bearing Co.; A. E. Juve, B. F. Goodrich Co.; J. H. Koenig, Rutgers University; R. E. Peterson, Westinghouse Electric Corp., and R. W. Seniff, Baltimore & Ohio Railroad Co.

NEWS

Celanese Introduces High-gloss Formulation

A formulation for the commercial production of high-gloss, water-thinned latex paint has been developed by Celanese Corp. of America, according to an announcement by Dr. O. V. Luke, Jr., manager of plastics research.

The new high-gloss formulation combines the selection of proper wetting agents and protective colloids with the production of extremely fine particles of resin of the proper molecular weight in the emulsion.

Ease and speed of application, absence of objectionable odor, rapid drying, easy brush clean up with soap and water, easy stain removal, ability to withstand scrubbing and absence of fire hazard while being applied are all characteristics claimed by Celanese for paints produced from the new formulation.

It is also claimed that whites will be completely non-yellowing, and colors will be cleaner and brighter than in conventional gloss paints. White paints from the new formulation are said to register 75-85 on a gloss meter.

Several paint manufacturers are now producing gloss paints for industrial and commercial use based on the Celanese emulsions, according to Charles Proudfit, director of sales for the resin products department. Semi-gloss paints can be made from the same emulsions and allied formulations, he said.

The new formulation resulted from a research program on polyvinyl acetate paints at the firm's paint research laboratory at Summit, N. J., under the direction of John Becker.

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New Laboratory Planned

Union Carbide Chemicals Co., Division of Union Carbide Corp., has approved plans for a technical service laboratory to be constructed near Tarrytown, N. Y. Completion has been set for early in 1959.

PAINT EXECUTIVE FETED: Lester Arnstein (center), president of Arnesto Paint Co., receives a placque commemorating his distinguished service to the industry and tireless devotion to a host of humanitarian causes at the annual paint and chemical industry dinner for the United Jewish Appeal. On hand for the presentation are (left to right) Robert I. Wishnick and William Wishnick, chairman of the drive, both of Witco Chemical Co., Irving Fein of Fein's Tin Can Co., and Albert M. Kahn of Albert M. Kahn & Associates.

Soybean Groups To Meet

The annual combined meetings of the American Soybean Assoc. and the National Soybean Processors Assoc. will be held at the Leamington Hotel, Minneapolis, Minn., August 26-28, it has been announced by George M. Strayer, executive vice president of the American Soybean Assoc.

The annual business meeting of the Processors Assoc. is scheduled for August 26, and the 37th annual convention of the American Soybean Assoc. is to be held on the following two days.

Acquires Pigment Firm

The acquisition of Thomasset Colors, Inc., of Newark, N. J., by Sterling Drug Inc., has been announced by J. Mark Hiebert, Sterling president.

Thomasset Colors manufactures the pigments Phthalocyanine Blue and Green as well as a line of drug and cosmetic colors. Dr. Hiebert said that the Thomasset company will be operated as a Sterling subsidiary.

Paul Thomasset, who founded the firm in 1946, will continue as its president.

Dr. O. V. Luke, Jr., manager of plastics research at Celanese' Summit, N. J., laboratories, points to the high degree of reflectivity shown by a sphere painted with high-gloss water-thinned latex paint made from the Celanese formulation.

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DOW REPORTS ON PROGRESS IN LATEX PAINT

New latex formulations revolutionize metal finishing

Now, for the first time, a water-thinnable system can perform equally well for metal finishing as traditional solvent systems. For years, rusting has been the big obstacle to using water-thinnable paints. But new Dow latex formulations solve this . . . and provide other exclusive advantages as well.

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Dow Coatings Research is perfecting a wide range of formulations, particularly in the field of industrial metal primers. To help you make latex metal paints for specific needs, you are invited to use Dow Coatings Technical Service. Phone or write THE DOW CHEMICAL COMPANY, Midland, Michigan – Plastics Sales Department PT,1919 V-2

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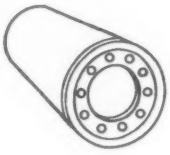

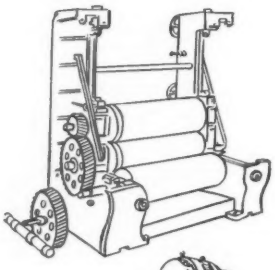

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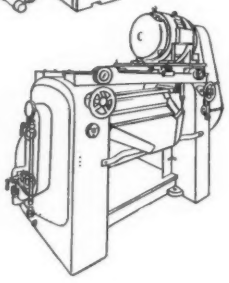

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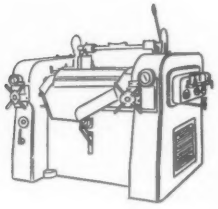

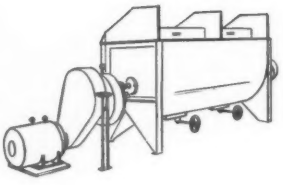

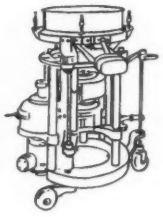

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NEWS

New Facilities for Diamonite

Diamonite Products Mfg. Co. of Canton, Ohio, has opened research laboratory, product development and pilot production facilities in connection with its recently occupied plant.

General offices of the firm have also been moved. The new address is 1232 Cleveland Ave., N. W., Canton 3, Ohio.

The new facilities include complete, modern ceramic, chemical, mechanical, petrographic and high temperature laboratories. The pilot plant is fully equipped for small scale production.

•

New Emery Subsidiary

Emery Industries, Inc., has formed a wholly-owned subsidiary in Canada with the acquisition of land, buildings, manufacturing facilities and existing fatty acid business of S. F. Lawrason & Co., Ltd., of London, Ontario.

The subsidiary, known as Emery Industries (Canada) Ltd., will be headed by R. T. Hull, who has been named vice president and general manager of the new organization.

According to the firm, installation of new equipment will enable the Canadian branch to produce a complete line of fatty acids for the Canadian market.

The new company will retain F. S. Lawrason & Co., Ltd., under the direction of Walter J. Evans, president, as exclusive sales agents in the Dominion.

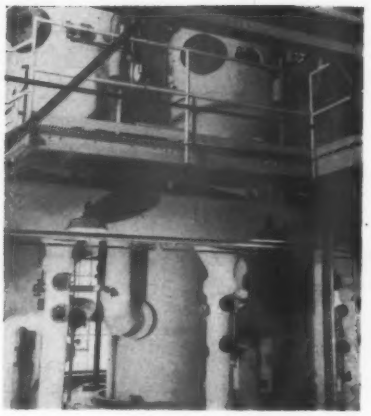
Lawrason has been a well-known producer of fatty acids in Canada for more than 75 years.

•

Hercules Opens PE Plant

Hercules Powder Co. has announced the opening of the first pentaerythritol plant in the Midwest at Louisiana, Mo. The multi-million-dollar plant is the first integrated PE facility in the country, and increases Hercules' total PE production capacity to approximately 50 million pounds annually.

The new unit has been designed to produce 24 million pounds of PE and 100 million pounds of formaldehyde, its basic raw material, annually. Also scheduled for rapid completion is a methanol plant which will produce 70 tons daily.



A view of the new Hercules plant showing a section of multi-effect evaporators where PE reaction mixture is concentrated prior to crystal separation.

The formaldehyde and methanol units will enable Hercules to produce all the major raw materials for the manufacture of PE. Acetaldehyde, another raw material, is already made by Hercules. The methanol operation will use the Swiss Inventa process for the first time in the United States.

The PE plant is equipped with automatic controls and other new process techniques. All of the grades of PE produced at the new plant will be of the dust-free type.

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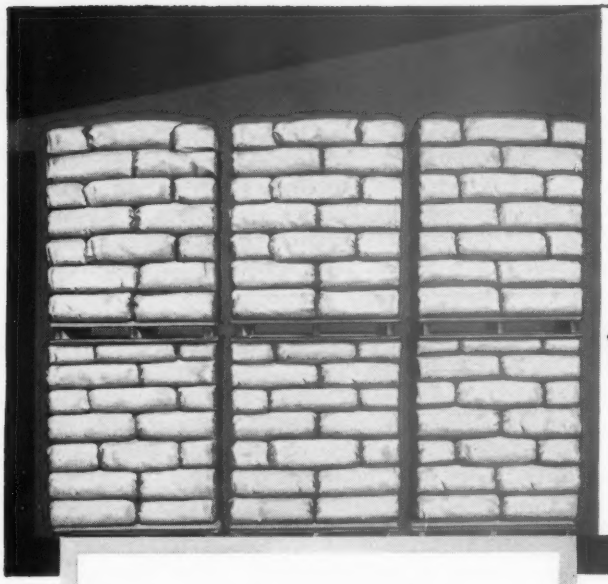

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NEW MATERIALS & EQUIPMENT

A MONTHLY MARKET SURVEY

This section is intended to keep our readers informed of new materials and equipment. While every effort is made to include only reputable products, their presence here does not constitute an official endorsement.

CHEMINEER

AGITATOR ACCESSORY

For Horsepower Determination

A dynamometer accessory for the ELB Experimental Agitator permits direct determination of required horsepower for mixing non-Newtonian fluids and gas-liquids. Company says accessory eliminates estimation.

Accessory consists of three-leg stand with adjustable leveling feet, ball thrust bearing mounting for ELB mixer and a moment arm assembly which pivots from a bracket fastened to one leg of the stand. Motor torque is transmitted through the arm to the pan of a laboratory scale, where the amount of the force is displayed in pounds.

Horsepower is determined by substituting derived values in the standard horsepower formula. Chemineer, Inc., Dept. PVP, 1044 E. First St., Dayton 2, Ohio.

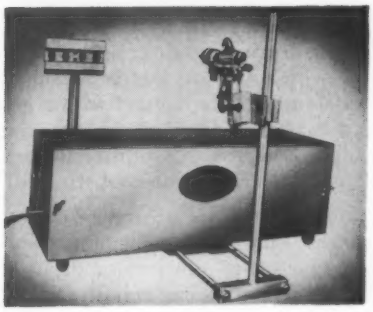
VAT COLOR PIGMENTS

From Yellow to Deep Red

Now in production are light-fast vat color pigments called "Century Colors," available in eight colors ranging from yellow to deep red.

Said to be for permanent and bright tints in pastel enamels, polychromatics, transparent or flamboyant enamels for lacquers, and many vinyl lacquers, pigments provide brightness and ease of dispersion.

Bulletin containing color chips, physical properties, physical tests and test results available from Kentucky Color and Chemical Co., Dept. PVP, 600 N. 34th St., Louisville 12, Ky.



ECLIPSE

ELECTRIC SPRAYING UNIT

For Accurate Color Matching

Electric test panel spraying unit has been announced, said to allow standardization of paint application on test panels. Company claims sprayer will precisely color match one paint batch with another.

Light weight portable electric model contains 1/6 horsepower explosion-proof motor. Fine control of panel speed, gun distance, angle and height are claimed. Sprayer is designed to hold any standard make spray gun, and can also be modified to allow greater variation of speed and gun adjustment to suit special requirements.

Available in both electric and air-motored models from Eclipse Air Brush Co., Dept. PVP, 390 Park Ave., Newark 7, N. J.

STEARIC ACID

Color Stable

Double pressed stearic acid that is guaranteed for color stability is being offered.

The product, called Neo-Fat 18-54, has a guaranteed color stability of 4.0 Red and 30 Yellow on a 5¼" Lovibond scale, after being subjected to 200 degrees C. for two hours. Said to be able to withstand high temperatures with minimum color degradation.

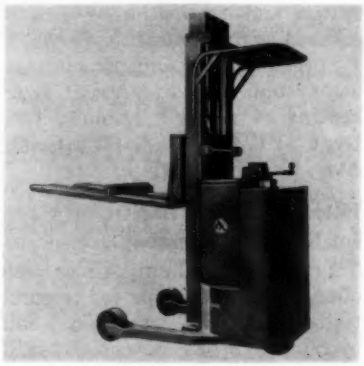
Armour Chemical Division, Dept. PVP, 1355 W. 31st St., Chicago 9, Ill.

ELECTRIC TIERING TRUCKS

Operate in Narrow Aisles

Riding-type electric tiering trucks are being offered with HydraFork attachments to facilitate their use in extremely narrow aisles.

Trucks have ten-inch diameter rubber-tired wheels for added floor protection. Can handle pallets of all widths.

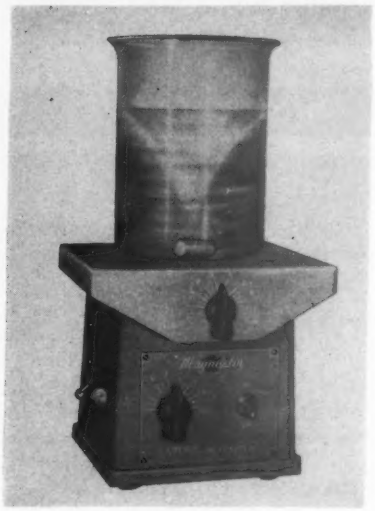


LEWIS-SHEPARD

HydraFork is available on all Lewis-Shepard Model "M" and "MN" electric tiering trucks in capacities to 3000 pounds. Trucks are operated from a stand-rest driving position, and are produced with a wide range of fork elevations.

Lewis-Shepard Products, Inc., Dept. PVP, 125 Walnut St., Watertown 72, Mass.

NEW MATERIALS — EQUIPMENT



LABLINE

MAGNETIC STIRRER
Can Also Be Heater

Triple duty six-inch magnetic stirrer, which serves as hot plate, stirrer, or both is now available. Said to be suitable for all types of laboratory stirring and heating.

Called Pyro-MagneStir, product contains die cast base enclosing built-in motor, rheostat speed control for motor, motor switch, six-inch square aluminum hot plate with built-in thermostat, hot plate switch and two seamless Teflon-covered stirring bars.

Special baffles and air circulating system said to prevent overheating of motor. Lablne, Inc., Dept. PVP, 3070-82 W. Grand Ave., Chicago 22, Ill.

TRIMETHYLOLPHENOL
For Resin Development

Trimethylolphenol in sample quantities is available for research testing and field evaluation. Said to have a broad potential use in industrial coatings and other chemical compositions where its structure and high reactivity could be of advantage.

New material is claimed to represent a significant advance over previous water-soluble phenolic resins in that it is a single chemical species. May be used as a building block to form new chemical compounds. Can also be used to form resins.

Chemical reactivity makes new product attractive as cross-linking agent for compounds or polymers containing active hydrogens. BR-LA1030, 70 per cent aqueous solution, is said to have viscosity of 50 to 70 centistokes at 25 degrees C.

Solution said to be miscible with methyl alcohol, ethyl alcohol and acetone. Will react as a one-step phenolic resin, slowly converting to a resin at room temperature. But in range of 150 to 160 degrees C., it will harden in 80 to 100 seconds. The reaction may be catalyzed by acids such as oxalic, phosphoric, or any water-soluble acid.

Bakelite Co., Division of Union Carbide Corp., Dept. PVP, 260 Madison Ave., New York 16, N. Y.

ABRASION TESTER
For Wet and Dry Tests

Production has been announced on a Multi-Directional Abrasion Tester for durability studies of materials such as floor finishes.

A complex rubbing and twisting action is achieved by contact of a reciprocating table, which holds the abrasive, and a rotary head to which the sample is attached. Instrument is equipped with a grit surface table and a rubber sheet table. Variety of additional abrasive surfaces may be substituted.

Stroke counter, clearer brush and an attachment for varying pressure on the sample insure standardized conditions for tests on both wet and dry surfaces.

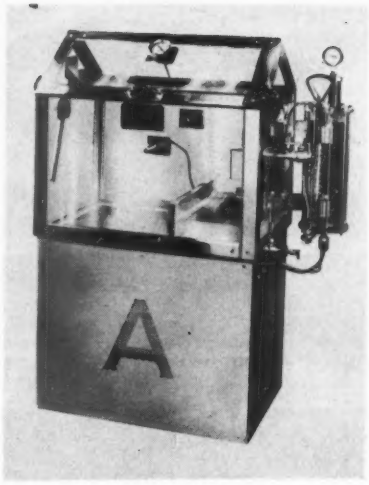
United States Testing Co., Inc., Dept. PVP, 1415 Park Ave., Hoboken, N. J.

VINYLTOLUENE COPOLYMER
Offers Controlled Thixotropy

Keltrol 1059 is the trade name of a thixotropic vinyltoluene copolymer recently developed. It is recommended by manufacturer as material for flat interior wall paints. Results claimed comparable to those of finest alkyd flat paints.

Product is described as offering controlled thixotropy with resultant easy workability and freedom from separation and hard settling. Said to give excellent non-penetration and color uniformity. No unpleasant after-odor, according to company.

Samples available from Technical Service Dept., Spencer Kellogg and Sons, Inc., Dept. PVP, Buffalo 5, N. Y.



ASSOCIATED

SALT SPRAY TEST CHAMBER
All-Lucite for Visibility

All-Lucite salt spray test chamber for determining salt fog corrosion resistance has been introduced. Said to have wide application for environmental salt spray tests.

Chamber produces fine mist and reaches test conditions within 15 minutes when connected to low pressure air supply. Specimens are suspended from Lucite hanger rods or placed on bottom of chamber supported by Lucite rods. All-Lucite construction said to assure complete visibility from all angles.

Chamber is equipped with temperature controllers and indicators. Dimensions are 20″ x 20″ x 20″. Larger sizes to special order. Contains steel base.

Associated Testing Laboratories, Dept. PVP, 412 Clinton Rd., Caldwell, N. J.

COATING RESIN
For Quick Drying Paints

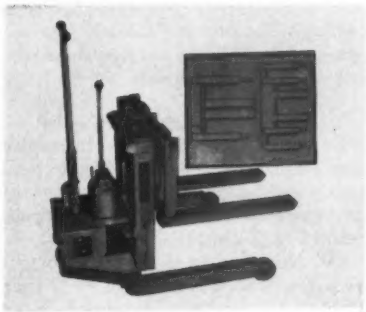
A coating resin soluble in mineral spirits has been developed specifically as a solution binder. Called Pliolite VT, resin is supplied in form of friable granules and can be solvated by using conventional equipment.

Complete solution is possible with aliphatic solvents having a Kauri Butanol value as low as 36. Films formed by evaporation of solvent rather than oxidation are said to show excellent clarity. Also said to be resistant to acids, alkalis and greases.

Solutions of the new product

provide rapid wetting of color pigments, according to company. Color dispersions may be prepared in ball or roller mills. Color selection said to be limited only by pigment availability. Suggested for use in traffic paint.

Chemical Division, Goodyear Tire and Rubber Co., Dept. PVP, Akron 16, Ohio.



LANGLEY

STRADDLE LIFT TRUCK
Handles Skids, Pallets, Rolls

Langley Multi-Purpose hand operated transporter accommodates various size skids, pallets and rolls, as well as machines and reels. Forks slide easily on polished shaft and are said to handle up to 48-inch board width pallets or skids.

Company manufactures two models, Model 30, which handles stringer lengths up to 36 inches, and Model 42, which takes up to 48 inches. Forks are high lifting, allowing load to be raised up to 14 inches. Double lifting chains on equalizing cross head provide maximum safety.

Product has one-ton capacity. Pull-push handle pivots 360 degrees for top manoeuverability, and oversize wheels overcome floor irregularities. Adjustable throttle valve permits variable lowering speeds from 0 to 20 feet per minute.

Langley Mfg. Co., Inc., Dept. PVP, 923 Cambridge St., Cambridge, Mass.

UNIVERSAL TINTING COLOR
Blends With All Base Whites

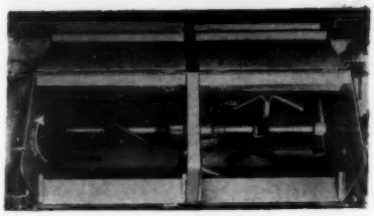
A universal tinting color is available said to blend with equal success with semi-gloss and flat alkyd vehicles, oleoresinous bases and latex systems.

Colorants are available either as one-shot tube system or standard shelf package form. System employs 12 basic colors capable of producing through cross-mixing a minimum of 288 tints for use with both interior and exterior paints. Standard shelf line offers 24 colors to accommodate every decorating requirement.

Test samples available from The Craftint Mfg. Co., Dept. PVP, 1615 Collamer Ave., Cleveland 10, Ohio.

HEAVY-DUTY MIXERS
Explosion-Proof Motors

NRM paint mixers are available in single and twin-tank units, with capacities from 80 to 150 gallons. Motors are fully enclosed and explosion-proof, states manufactures.



NATIONAL

Single tank mixers have either side or overhead drive. Mixing blades said to combine compressive and shearing action for mixing material thoroughly in less time.

National Rubber Machinery Co., Dept. PVP, 384 Getty Ave., Clifton, N. J.

The "Pony" Paste Mixer comes in 2 convenient types:
TYPE 1—With portable turntable *(shown)*. Tilt the mixing head out of the batch; the turntable becomes a dolly on which to transport the can.
TYPE 2—With attached turntable. The can is removed at the machine.
Both types are available with a single mixing speed of 45 RPM or a variable speed of 30-90 RPM. Choose from 60 or 80 gallon working capacities.

NOW! A Change Can Mixer with the Performance Advantages of a Heavy Duty Paste Mixer!

Unique mixing action! There you have the "secret" of the "Pony" Paste Mixer. This machine combines the mixing advantages of the sigma blade, or heavy duty, paste mixer with the versatility and ease of cleaning of a change can mixer. Here is how it works:

The "Pony" Mixer's 2 sets of U-shaped blades approach its two stationary breaker bars at a constantly diminishing angle, compressing the materials caught between. This creates intense shear and excellent wetting.

The staggered position of the blades permits these intense actions to be in rapid series. This reduces the load on the machine and permits the handling of heavy pastes with comparatively little power requirements.

The wide tapered bottom blades impart an upward thrust and rolling action to the material. The can rotates in the same direction as the mixing blades at an unsynchronized rate of speed. The entire batch is constantly agitated, constantly moving; "dead" spots and stratification of materials are eliminated. This, plus the intense shear developed, guarantees superior wetting, a homogeneous batch and reduces the load in the final grinding process.

Find out how the "Pony" Mixer can help *you*. For a free, illustrated folder, fill in and mail the coupon *today!*

Close-up of the "Pony" Paste Mixer's 2 sets of U-shaped polished steel blades. These heavy blades revolve around 2 stationary, polished steel breaker blades. Compression and shear developed is intense. Wetting action is excellent. Stirring action is continuous. "Dead" spots and stratification are completely eliminated.

Herman Hockmeyer and Company PVP-77
341 Coster St., New York 59, N. Y.
GENTLEMEN: Please send me your free, illustrated folder describing the "Pony" Paste Mixer in complete detail.
My name is.....
Company.....
Address.....
City..... *Zone*... *State*.....

HERMAN HOCKMEYER & CO.
341 COSTER ST., NEW YORK 59, N. Y.

PERSONNEL CHANGES

NOPCO

Albert W. Silvain has been named manager of the firm's protective coatings division, it has been announced.

Mr. Silvain is a graduate of St. Peters College, and has been with the firm for six years. He will be responsible for the development and sales of processing chemicals.

F. R. Gagnier and **D. E. Murphy** will handle sales of industrial processing chemicals out of the new Los Angeles sales office, located at 4858 Valley Blvd.

HEYDEN NEWPORT

A. M. Seher has been named Cincinnati district manager of the firm's Newport Industries Co. division, it has been announced.

Mr. Seher joined the firm in 1946 as a member of the sales department. He had previously been associated with the paint division of Interchemical Corp. as a chemist. He holds a B.A. from Villa Madonna College, and also attended Wesleyan University.

Fred J. Stief has become the division's Chicago district manager, it has also been announced.

Mr. Stief has been with the sales department since 1951. He had previously been chief chemist of Alabama Paint Co., and had been with the paint division laboratory of the Interchemical Corp. He graduated from Xavier University in 1950 with a B.S. in Chemistry.

SYLOID® 162

Davison's NEW Alkyd-Urea Flatting Agent, for Synthetic Finishes, gives you

MORE FLATTING POWER AT LOWER COST

Laboratory tests and actual use tests have proven that **SYLOID 162:**

- **can be ground in one-quarter the time required by other varnish flatting agents.**
- **the flatting power is two to three times greater than existing materials.**
- **twice as much can be ground in a single mill charge.**
- **the high and low tones are not destroyed as with present varnish flatting agents.**
- **films are tough, durable and mar resistant.**
- **has an exceptionally high chemical purity.**
- **chemical properties are controlled to insure uniform performance.**
- **there is no "seeding".**

For further information on SYLOID 162—the alkyd-urea varnish flatting agent that gives you better performance at lower cost—write

Progress Through Chemistry

DAVISON CHEMICAL COMPANY

Division of W. R. Grace & Co.

BALTIMORE 3, MARYLAND

Producers of Catalysts, Inorganic Acids, Superphosphates, Triple Superphosphates, Phosphate Rock, Silica Gels and Silicofluorides. Sole Producers of DAVCO® Granulated Fertilizers.

SHERWIN-WILLIAMS

Dr. Claude A. Lucchesi has been named director of the analytical research department, it has been announced by A. B. Holton, technical director.

C. A. Lucchesi

Dr. Lucchesi holds a doctorate in Chemistry form Northwestern University. He had been associated with the Shell Development Co. in Houston prior to joining the firm in 1956.

He is the author of several papers on analytical problems in X-ray fluorescence, spectrography, boron chemistry and instrumental analysis.

UNION CARBIDE CHEMICALS

Dr. R. I. Hoaglin, A. E. Montagna and **Dr. H. W. Schultz** have been appointed associate directors of the development department of the firm's South Charleston, W. Va., plant.

Dr. Hoaglin joined the development department after receiving a Ph.D from Purdue University. He also received an M.S. at Purdue, and an A.B. at Wabash College. He had been assistant director of the development department prior to his promotion.

Mr. Montagna has been with the department since 1936, and had been technical supervisor prior to his promotion. He graduated from Bethany College in 1936.

Dr. Schultz has been with the department since 1934. He attended Columbia University, where he received B.S., M.S. and Ph.D. degrees in Chemical Engineering.

R. M. Berg has been appointed administrative assistant to the director of the department.

Mr. Berg joined the company after receiving a B.S. in Electrical Engineering from the University of Wisconsin in 1940. In addition to his new assignment, he also heads the quality control laboratory.

R. M. Joslin, sales manager of industrial chemicals, and **W. A. Woodcock,** manager of the fine chemicals department, have exchanged assignments.

Mr. Joslin joined the firm in 1935, after graduating from Wesleyan University. He served successive assignments as district manager of the Atlanta, Detroit and Philadelphia districts, and was manager of the central division and assistant sales manager before he became sales manager of industrial chemicals in 1956.

Mr. Woodcock joined the firm's organic synthesis fellowship at Mellon Institute of Industrial Research in 1936 after several years of teaching. He holds a B.A. from Hamilton College.

WERNER G. SMITH

John D. Hetchler has been appointed to head the firm's newly formed chemical division, it has been announced.

The new division will be located in Cleveland and will manufacture chemicals derived from oils and fats.

Mr. Hetchler has been in the fats and oils industry for more than 20 years. He has been sales manager of the chemical products division of Archer-Daniels-Midland, and has served as assistant plant manager and as manager of sales and technical services for the New York area and later as chemical director of Wyandotte Oil and Fat Co. He is a graduate of Michigan State University.

E. W. Kaufmann will handle sales of sperm oil and chemical products in the Philadelphia area. He had previously been sales manager of the resin division of Archer-Daniels-Midland.

Mr. Kaufmann, a Chemical Engineering graduate of Lehigh University, has spent 20 years in sales and technical services in the Philadelphia area.

GENERAL ELECTRIC

S. F. Long has been named manager of the Chicago district sales office of the silicone products department by J. T. Coe, department sales manager.

Mr. Long is one of the department's senior salesman. He has been transferred from the Boston office, where he had been located for the past ten years.

He holds a degree in Mechanical Engineering from Rhode Island State College in 1947.

REARDON CO.

Frank P. Murphy has become a sales representative for the firm's line of building construction, maintenance and repair products in southern California, Arizona and the Las Vegas district of Nevada.

Mr. Murphy is an alumnus of McDonald College, Montreal. He had been in sales work in the Los Angeles area for seven years before joining the firm.

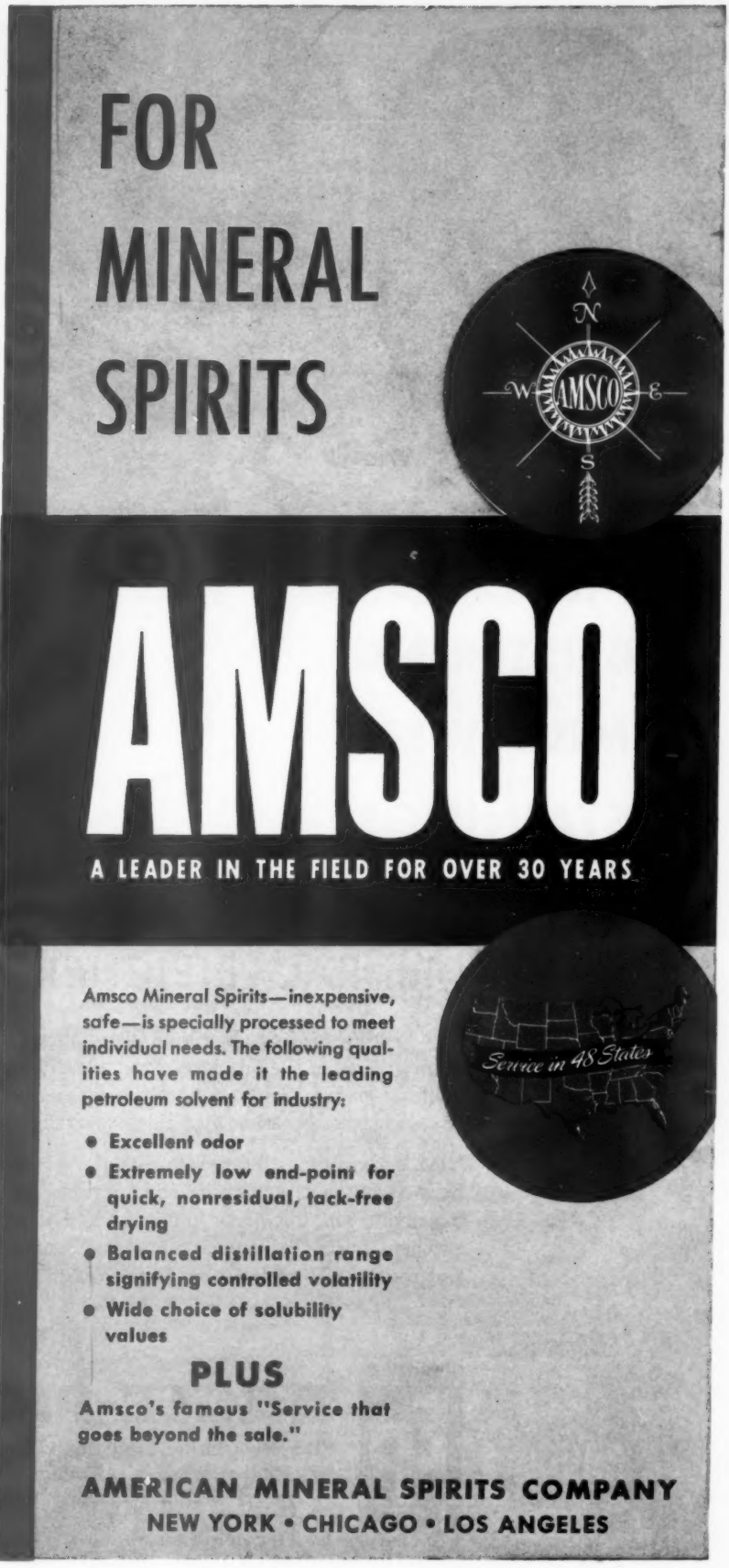
CONTINENTAL CAN

L. A. Piper has been appointed acting district sales manager for the Syracuse sales office of the firm's metal division, it has been announced by R. D. Heaviside, general manager of the northeastern district.

Mr. Piper had been assistant district sales manager of the division's New York sales office. He replaces **C. W. Smith,** who has joined the Hazel-Atlas glass division.

FREEMAN CHEMICAL

Kenneth R. Heilmann has been appointed assistant sales manager, it has been announced. He will be located in St. Louis.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AMSCO
A LEADER IN THE FIELD FOR OVER 30 YEARS
Service in 48 States
Amsco Mineral Spirits—inexpensive, safe—is specially processed to meet individual needs. The following qualities have made it the leading petroleum solvent for industry:
• Excellent odor
• Extremely low end-point for quick, nonresidual, tack-free drying
• Balanced distillation range signifying controlled volatility
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PLUS
Amsco's famous "Service that goes beyond the sale."
AMERICAN MINERAL SPIRITS COMPANY
NEW YORK • CHICAGO • LOS ANGELES

Problems:
BLISTERING!
MILDEW!
STAINING!

Solution: Formulate your flat house paints with EAGLE-PICHER Zinc Oxides!

New low-luster or flat-breather type house paints have been able to solve some of the problems posed by wide differences in today's building materials, but they also have created other hazards—blistering, discoloration by mildew growth, and unsightly staining.

Now, extensive testing proves that these hazards can best be solved by including zinc oxides in your formulations. And the surest way to provide your low-luster house paints with superior mildew resistance, excellent blister resistance, minimized tannin staining and better tint retention is to *insist on Eagle-Picher Zinc Oxides.*

Since 1843

EAGLE EP PICHER

EAGLE-PICHER

The Eagle-Picher Company • Cincinnati 1, Ohio
Regional sales offices: Atlanta, Chicago, Cleveland, Dallas, New York, Philadelphia, Pittsburgh

West Coast sales agent: THE BUNKER HILL COMPANY, Chemical Products Division
Seattle • Portland • Oakland • San Francisco • Los Angeles • Kellogg, Idaho

VELSICOL

J. G. Kronseder

E. W. Phares

Elwood W. Phares has been promoted to the position of manager-marketing and commercial development, according to an announcement by Dr. Robert C. Sauer, vice president-research and development.

Mr. Phares has been conducting sales development work since 1956. He received a master's degree in Business Administration from the Harvard Graduate School, and a degree in Industrial Engineering from Rensselear Polytechnic Institute. He is a member of the American Chemical Society, the Society of Plastics Industries and the American Management Assoc.

John G. Kronseder, formerly manager of chemical engineering for International Minerals & Chemical Corp., has been appointed assistant director of process development.

Mr. Kronseder received a B.S. in Chemical Engineering from the Newark College of Engineering. He is a member of the ACS, AMA and the American Institute of Chemical Engineers.

PICCO

Bernard J. Davis has been named district manager of the newly created New Orleans district office, the firm has announced.

A graduate of Temple University, Mr. Davis joined the firm early in 1956, after service with Shell Oil Co. covering resins, solvents, oils and industrial chemicals.

He was previously associated with American Cyanamid Co. in technical service and sales development.

PHOTOVOLT

Dr. Gabor B. Levy has been appointed a member of the firm's management staff, it has been announced.

Dr. Levy holds and engineering degree as well as a Ph.D in Chemistry. He has been active in physical and analytical chemistry, instrumentation and laboratory management. He will concern himself primarily with development and applications research.

WITCO

J. A. Osadnick has been promoted to regional purchasing agent for all divisions of the firm, it has been announced.

Mr. Osadnick will be in charge of a newly consolidated purchasing office serving all Midwestern plants of the company.

He joined the firm in 1945 as an assistant in the company's Chicago purchasing department. He later became purchasing agent in the Midwestern area.

PATTERSON

George Milburn has been appointed sales supervisor in Canada, it has been announced.

In his newly-created position, Mr. Milburn will coordinate district sales activities in Canada to facilitate customer service. His headquarters will remain in Montreal.

He joined the firm in 1946, and was named manager of the Montreal office after a short period in the Toronto sales office.

NAPKO

George L. Wiseman has been promoted tc plant superintendent, it has been announced. He had formerly been plant foreman.

Mr. Wiseman attended Franklin Technical Institute before joining the firm more than ten years ago.

L. J. Gurganus has been promoted from shipping clerk to traffic manager, it has alsc been announced.

Mr. Gurganus jcined the company in 1947.

PICCO

Donald B. Morgan has become a member of the firm's New Orleans district sales staff, it has been announced.

Mr. Morgan had previously been with the technical service laboratory since August, 1955. He is a graduate of Grove City College.

Paint manufacturers, too, Save with Nopco "One-Stop" Buying

A COMPLETE LINE

Nopco's complete line of paint additives provides emulsion paint producers with the opportunity for important savings. Grouped orders qualify for quantity price discounts... Save substantially on freight, too.

Look into the *complete* Nopco line today and take advantage of these extra savings.

Write for booklet which describes the Nopco line fully. Nopco Chemical Company, Harrison, N. J.

NOPCO PAINT SPECIALTIES:

Anti-foaming agents
Pigment dispersing agents
Freeze-thaw stabilizers
Thickeners
Viscosity stabilizers
Surface active agents
Pigment mixing and grinding aids

1907–1957 50 Years of Progress in Chemistry

NOPCO

PLANTS: Harrison, N. J. • Cedartown, Ga.
Richmond, Calif. • London, Canada

JONES-DABNEY

M. O. Wiley has been appointed vice president and sales manager of the automotive finishes division, it has been announced.

Mr. Wiley has been with the firm since 1948. He succeeds **George K. Graves,** who is retiring after 34 years in the automotive phase of the paint industry.

AMERICAN CYANAMID

Thomas J. E. Holmes has been named sales representative for the newly established sales and warehouse facilities of the firm's pigments division at Detroit, it has been announced.

Mr. Holmes, who has been with the firm since 1948, was assigned to the Cleveland office prior to receiving his new post.

ZAC-LAC

Walter L. Ziegler has been named to the executive staff of the firm, where he will become technical director in charge of plant operations.

Mr. Ziegler had previously served for 22 years with the R. A. Becker Co. as plant manager and technical director. While with the Becker Co., he became president of the Cincinnati-Dayton-Indianapolis-Cleveland Production Club.

He is a graduate of the University of Cincinnati, where he received a degree in Chemistry.

HERCULES

Frank H. Crymes has been named to the newly created position of manager of sales training for the synthetics and cellulose products departments, it has been announced.

Mr. Crymes had been manager of the synthetics department's Chicago district for the past three years.

F. H. Crymes

B. J. Dougherty

B. J. Dougherty, former manager of the synthetics department's St. Louis district, has been named to succeed Mr. Crymes as manager of the Chicago district.

James G. Antonak has been appointed technical sales representative in the St. Louis district. He had been in the Chicago district in the same capacity for the past five years.

Robert W. Crabtree, manager of nitrogen product sales for the explosives department, has been named manager of chemical sales. He has been with the firm since 1934.

BAKELITE

Robert D. Swain has been appointed a technical representative for the surface coatings division in a newly-established district office in Washington, D. C., the firm has announced.

Mr. Swain will continue to serve a territory which runs along the east coast from Maryland through South Carolina, and which extends westward into Tennessee.

Mr. Swain has been with the firm since 1951, after graduation from Lafayette College with a B.S. in Chemical Engineering. He has also been a technical representative in New York and Philadelphia.

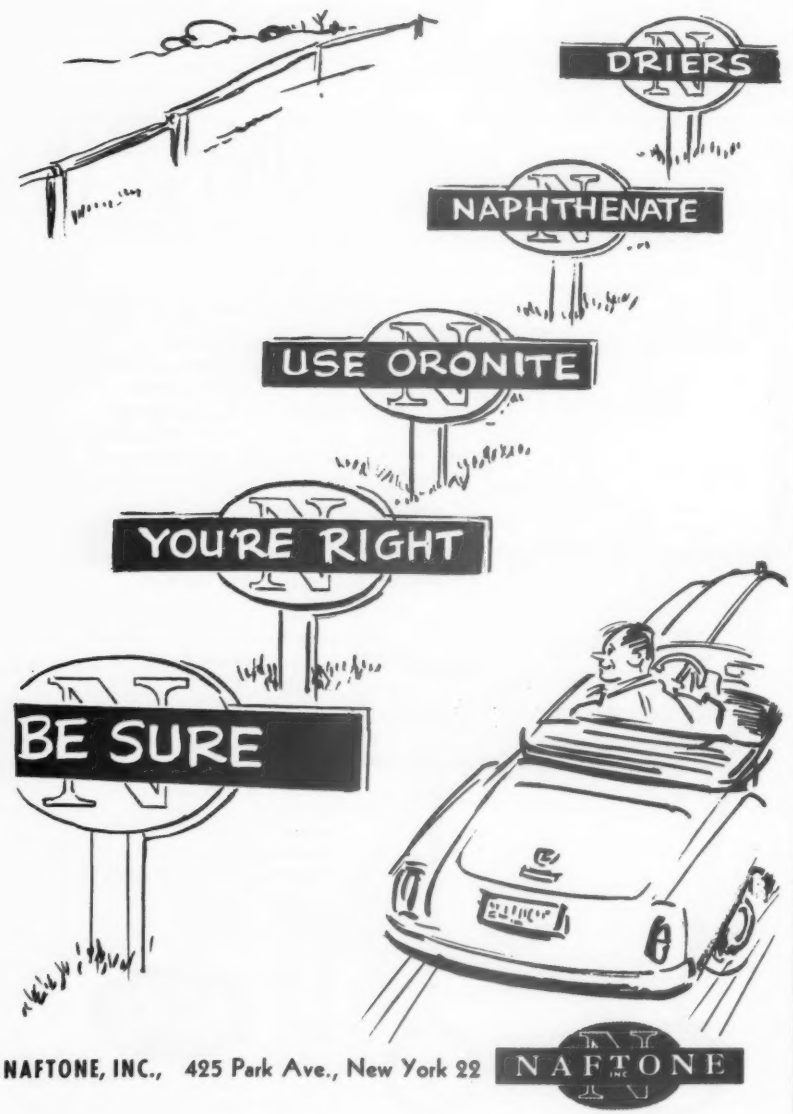
GENERAL ANILINE & FILM

Sumner H. Williams has become co-ordinator of sales programming for the dyestuff and chemical division, it has been announced by Philip M. Dinkins, vice president of the company and general manager of the division.

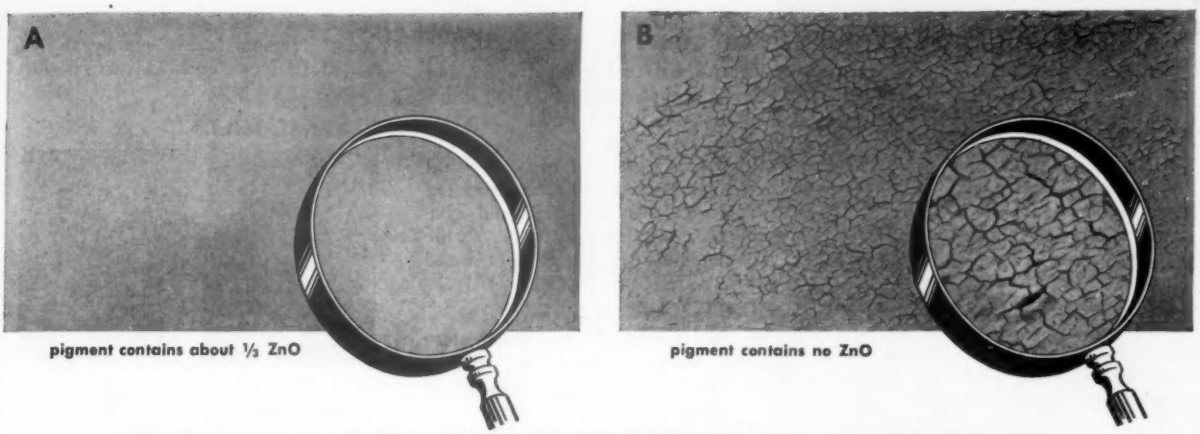
Mr. Williams will act as chairman of the new sales programming committee. He will also serve as technical sales consultant in developing sales and customer relations among major uses of dyes, pigments, surfactants and chemicals.

He has been with the firm since 1928, and has been a vice president since 1952. He has also been general sales manager and assistant general manager.

Mr. Williams is the inventor of the Williams Unit, which is used in the dyestuff and textile industry as a continuous operation piece goods dyeing machine.



NAFTONE, INC., 425 Park Ave., New York 22 NAFTONE



Are you using enough ZnO for adequate

OPACITY TO ULTRA-VIOLET LIGHT?

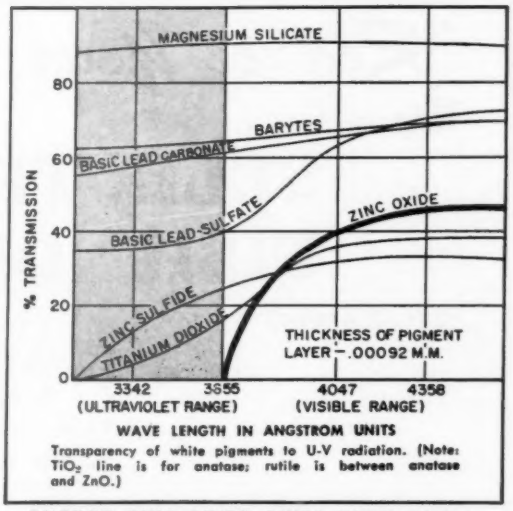
The test-panels above are coated with standard-specification exterior paints. The pigment-vehicle balance is identical in both paints. The only difference: zinc oxide constitutes about one-third of the pigment of paint A; paint B contains no zinc oxide. The two panels were simultaneously exposed to ultraviolet light in a laboratory.

The result? Paint A remains intact. Paint B has failed by cracking. The reason: zinc oxide's opacity to ultraviolet light. As the chart at right indicates, even a thin layer of zinc oxide provides total U-V absorption, outperforming all other reactive and non-reactive white pigments. ZnO is even more effective than lampblack and most colored pigments. Its presence — in sufficient quantities — ensures against destructive U-V penetration, which results in binder deterioration, bleaching, cracking.

The qualities that an adequate zinc oxide content imparts to any good paint are well known... and time-proved. But, in balancing a formulation, zinc oxide levels may be cut too far for customer satisfaction. With this in mind, consider:

Are you formulating your paints for maximum possible quality?

Are you formulating your paints with enough zinc oxide?



Transparency of white pigments to U-V radiation. (Note: TiO_2 line is for anatase; rutile is between anatase and ZnO.)

ENOUGH ZINC OXIDE GIVES YOUR PAINT...

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- Durability
- Mildew resistance
- Tint retention
- Self-cleansing action

Technical reports are now being prepared by member laboratories of AZI on the benefits of proper zinc oxide usage. To receive copies, mail coupon.

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CUNO

Walter J. Holder has been named manager of the firm's Micro-Klean Filter Division, it has been announced by Carlton H. Winslow, vice president of the corporation.

W. J. Holder

Mr. Holder comes to the firm after five years with the Indiana Commercial Filters Corp. and Honan-Crane Corp. of Lebanon, Ind. He has also been associated with the machine tool industry.

He is a graduate of the University of Buffalo, and is a member of the American Society of Tool Engineers and the American Society of Lubrication Engineers.

FERRO CORP.

Jerome Kurtz has been appointed technical service engineer for the firm's subsidiary, Ferro Chemical Corp., it has been announced.

Mr. Kurtz, a graduate of Long Island University, has recently been associated with General Aniline. He will give technical assistance to users of the firm's polyvinyl chloride resin heat and light stabilizers.

ORONITE

W. M. Burge, former midwestern regional sales manager, has become West Coast regional sales manager in San Francisco.

H. B. Pollock has succeeded Mr. Burge as midwestern sales manager at the firm's Chicago headquarters.

T. M. Welton, former Chicago sales manager, and more recently Pacific Coast regional sales manager, has moved to New York as eastern sales manager.

GENERAL MILLS

F. J. McNamara

H. L. Ritell

Frank J. McNamara has been appointed eastern sales representative for the chemical division, according to an announcement by Alfred G. deMeurisse, New York district sales manager.

Mr. McNamara will be responsible for sales of Versamid polyamide resins, fatty nitrogen compounds, fatty acids, fatty methyl esters and sterols. He is a graduate of Fordham University and was previously associated with Fritzsche Bros., Inc.

Henry L. Ritell has been also named an eastern sales representative for the chemical division. He has been an industrial chemical salesman for Victor Chemical, and has also been associated with Heyden Chemical Corp. and the research section of Lederle Laboratories Division, American Cyanamid.

A graduate of Fordham University, Mr. Ritell is a member of the American Chemical Society.

Alby Wolf, who has received a B. Ch. E. from the University of Minnesota in June, is now a member of the chemical engineering research department, it has also been announced.

Mr. Wolf has been with the company on a part-time basis while completing his studies.

ARMOUR

B. H. Tannel has been named southeastern area sales representative for the firm's chemical division with headquarters at Charlotte, N. C., according to an announcement by director of sales B. W. Graham.

B. H. Tannel

Mr. Tannel is a graduate of Marquette University, where he majored in Chemistry. Prior to joining the firm in 1956, he did research work with a container company. He has been in the use research laboratory and in sales since then.

He will be responsible for sales in North and South Carolina, Georgia, Alabama, Florida, Mississippi and part of Tennessee.

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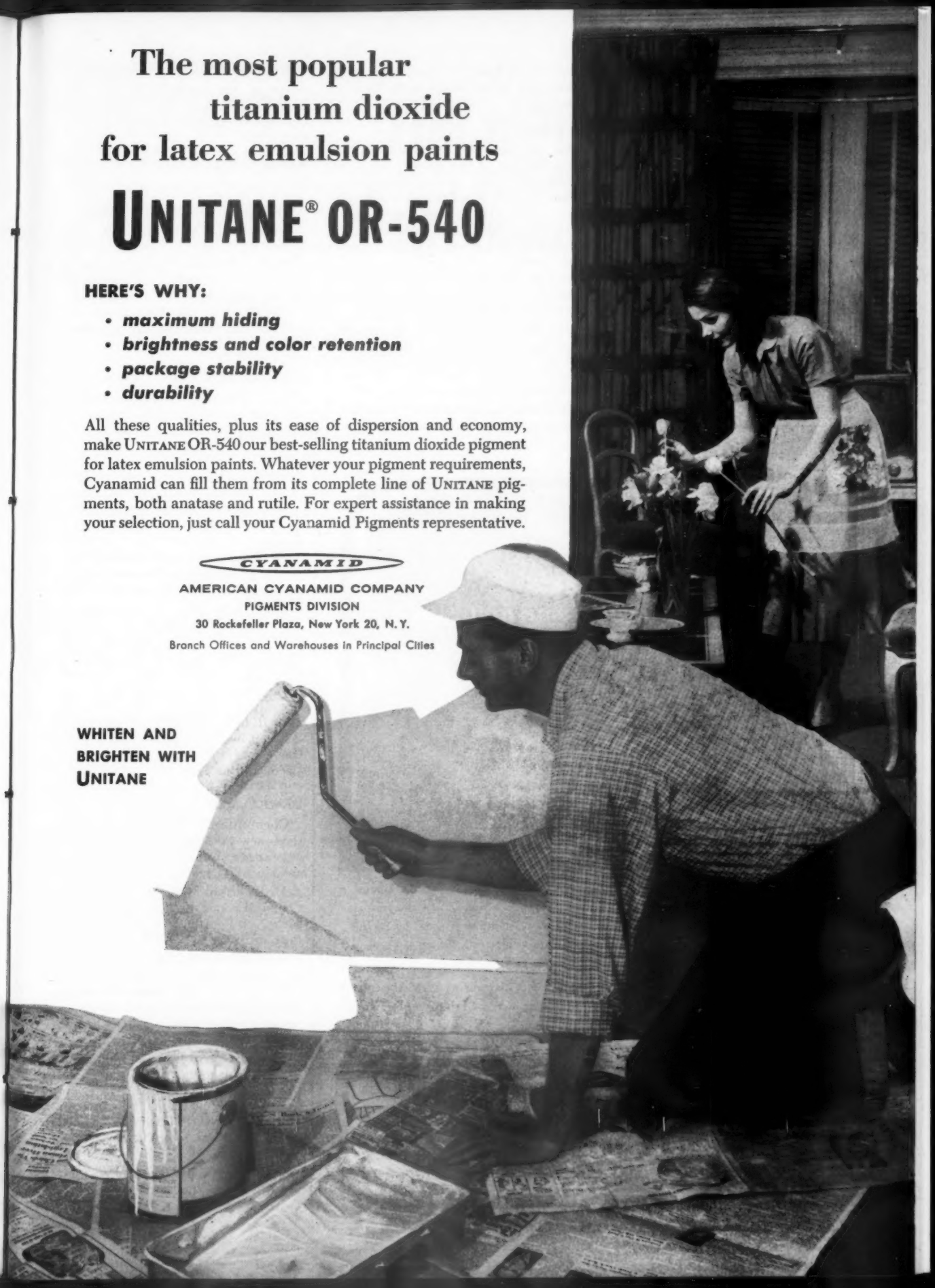

PONTIAC VARNISH

Joseph J. Torma has been appointed factory manager, and **Fabian S. Oberg** has been named superintendent, it has been announced by the firm.

J. J. Torma

F. S. Oberg

Mr. Torma, formerly associated with the Ford Motor Co. and Detroit Graphite Co., has more than 20 years of experience in industrial paint formulation and production.

Mr. Oberg joined the firm in 1927, and has served continuously in the factory organization.

DUPONT

Dr. Clement W. Theobald has become director of the research division of the fabrics and finishes department, it has been announced. He succeeds James B. Bullitt, Jr., who died in May.

Dr. Theobald had been assistant director of the research division since last February. He has been with the company since 1943, when he became a research chemist in the chemical department experimental station.

He received his Ph.D. in Organic Chemistry from the University of Illinois. He holds bachelor's and master's degrees from the University of Nebraska.

William D. Lawson has taken Dr. Theobald's position as assistant director of the research division. He joined the company in 1949 as a research chemist at the Marshall Laboratory.

Mr. Lawson holds a degree in Chemical Engineering from Cornell University.

AMERICAN CHEMICAL PAINT

Charles R. Wirshing has been named metal working chemicals sales manager, West Coast district, according to an announcement by Gerald C. Romig, president.

Mr. Wirshing joined the firm's sales staff ten years ago, and was transferred to Niles, Calif., in 1952.

MILTON ROY CO.

John Procopi has been appointed the firm's sales manager, it has been announced by W. T. Griffiths, vice president of marketing.

Mr. Procopi had been manager of market development for the past four years. He was previously engaged in advertising and sales promotional work for Minneapolis-Honeywell Regulator Co.

He is a graduate of Columbia University with a B.S. in Chemistry, and is a member of the American Institute of Chemical Engineers.

H. Rodman Smith has been named assistant sales manager and will direct several phases of the firm's marketing activities, it has also been announced.

Mr. Smith has been the firm's chief application engineer. He graduated from Lehigh University in 1949 with a B.S. in Chemical Engineering. He is a member of the American Institute of Chemical Engineers.

DEWEY AND ALMY

Cornelius F. Sullivan is one of three new sales representatives for the organic chemicals division, it has been announced.

Mr. Sullivan, formerly with the Dow Chemical Co.'s plastics division, will cover New England. He is a graduate of Boston College.

William A. Morton will report to the Chicago office. Holder of a B.A. in Chemistry from Wesleyan University, he spent seven years in sales and market research with the J. T. Baker Chemical Co.

James H. Aungst, a graduate of Toledo University, will cover South Carolina, Georgia and Florida, with headquarters in Atlanta. He had previously been with Darling & Co. for three years, and Merck & Co. for two years.

Mr. Aungst replaces **Oscar W. Kaalstad,** who has transferred to the West Coast.

The "just-painted" look lasts longer with Dicalite 5½ years of continuous exposure in Florida weather proved that house paints formulated with Dicalite weather more slowly, look 'new' longer. The tougher, more elastic, paint film provided by Dicalite holds the pigment particles longer — delays chalking, resists blistering, flaking and peeling.

Painters like Dicalite-aided paints for their improved brushability and leveling properties. Houseowners like them because Dicalite-aided white paints are really white, Dicalite-aided colored paints are fresh and clean, not muddy. And paint makers like Dicalite because it makes expensive prime pigments go so much further! WRITE TODAY FOR THE NEW DICALITE C-23 PAINT BULLETIN.

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NEWS

Expand Japan Soy Project

Expansion of a market development project for U.S. soybeans and soybean products in Japan during the next two years has been announced.

George M. Strayer, executive vice president of the American Soybean Assoc., said that a contract between the Association and the Foreign Agricultural Service of the U.S. Dept. of Agriculture provides for expenditure of $300,000 in Public Law 480 funds for soybean market development work in Japan in the coming two-year period.

During the last year $75,000 was spent for the same purpose. Additional funds for the project will be required from the U.S. soybean industry and Japanese trade groups, according to Mr. Strayer.

The soybean market development project in Japan was initiated early in 1956, sponsored jointly by the Soybean Assoc. and the Foreign Agricultural Service. It was operated through the Japanese-American Soybean Institute in Tokyo. The same arrangement will be continued for the next two years.

Mr. Strayer said that Japan is the leading customer abroad for U.S. soybeans. He said that approximately 25 per cent of the farmer's cash income from soybeans comes from exports.

An exhibit of U.S. soybeans and soybean products was entered in the International Trade Fair at Tokyo, recently.

New Vinyl Stearate Plant

Production of vinyl stearate in commercial quantities is expected to begin by the end of the year at Air Reduction Chemical Co.'s new plant at Calvert City, Ky.

According to C. J. McFarlin, president, the plant will have an annual capacity of two million pounds and will employ a process developed in the firm's research laboratories. Polyvinyl stearate, a hard synthetic wax, will also be produced.

The new plant is the fifth to be built on this site.

The man who rolled his own

Then there was this P.A. of *exceedingly* individual tastes. Couldn't abide ready-to-wear suits. Had his shirts hand-stitched. Even rolled his own cigarettes — couldn't find any packed to his liking.

You could see it coming when we made our first call. "We use only raw materials *exactly* suited to our processes. Not that we don't *like* to save money, you know, but..."

"Of course," we said, fetching up an ambrosial sample, "and we think our ACINTOL® FA — Tall Oil Fatty Acid is tailor-made for your alkyds." He picked up the bottle gingerly. *"Tailor-made?* But, remember, we need excellent color stability." We said, "Couldn't fit better."

He frowned. "But odor is a vital consideration, and naturally we couldn't..." We lifted the lid, he sniffed carefully, then took a last deep breath. "But isn't it —" he blanched —"cheap?" We thought he had us there, but we said, "Well, let's say it's — economical!"

"Young man," he said, "you seem to have a perfect understanding of our particular needs," and signed on the dotted line — not only for ACINTOL® Fatty Acid, but for our ACINTOL® D — Distilled Tall Oil.

If you are particular, too, about what goes into your alkyds, esters, emulsions, fatty acid amines, non-ionics, primer surfaces for automobiles, sulfonated oils or the like, look into ACINTOL® Tall Oil Products. It's so easy to get samples, typical analyses, technical assistance — just ask us!

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PATENTS

Complete copies of any patents or trade-mark registration reported below may be obtained by sending 50c for each copy desired (to foreign countries $1.00 per copy) to the publisher.

Polyepoxy Copolymers

U. S. Patent 2,788,339. Henry S. Rothrock, Wilmington, Del., and William K. Wilkinson, Waynesboro, Va., assignors to E. I. du Pont de Nemours and Co., Wilmington, Del., a corporation of Delaware.

A solid polyepoxy copolymer of allyl glycidyl ether and vinyl acetate having a molecular weight of above 1000 and consisting essentially of from 3% to 30% by weight of polymerized allyl glycidyl ether and from 97% to 70% by weight of polymerized vinyl acetate.

Carboxymethyl Protein As A Stabilizer

U. S. Patent 2,788,336. Eugene Henry Uhing and Leonard L. McKinney, Peoria, Ill., assignors to the U.S.A. as represented by the Secretary of Agriculture.

A butadiene-styrene latex emulsion paint containing as an emulsion stabilizer from 1 to 30 percent of carboxymethyl protein which contains 3 to 15 percent carboxymethyl groups based on the weight of the protein.

Berlin Blue

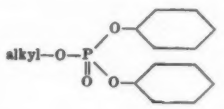
U. S. Patent 2,793,133. Hans Verbeek and Eberhard Gratzfeld, Wesseling, Bezirk Koln, Germany, assignors to Chemische Fabrik Wesseling A.-G., Wesseling, Bezirk Koln, Germany.

In a process for the production of Berlin blue pigment by precipitation of Berlin white from a reaction solution comprising a ferrous salt and an alkali metal ferrocyanide and oxidation of said Berlin white to produce Berlin blue, the steps which comprise incorporating in the liquid reaction solution 5 to 40%, calculated on the weight of the pigment produced, of an organic lacquer constituent selected from the group consisting of lacquer plasticizers, non-oxidative-drying film forming lacquer oils, high-boiling lacquer solvents and film forming lacquer resins effecting the precipitation of Berlin white from the reaction solution in the presence of said lacquer constituent to provide a coating of said lacquer constituent on the Berlin white as it is precipitated and oxidizing said coated Berlin white to Berlin blue.

Lacquer Formulation

U. S. Patent 2,793,959. Henry C. Pospychala and Garrett H. Peters, Rhinelander, Wisc., assignors to Rhinelander Paper Co., Rhinelander, Wisc., a corporation of Wisconsin.

A lacquer comprising a volatile quick-drying solvent mixture of 35-65 volume percent ethyl acetate, 10-30 volume percent ethyl alcohol and 20-40 volume percent toluol having dissolved therein from 10 to 50 weight percent of a coating composition consisting essentially of 42 to 46 parts of cellulose nitrate, 34 to 39 parts of an alkyl diphenyl phosphate plasticizer having the formula:



17 to 22 parts of glycerol-rosin-maleate, 2 to 5 parts of paraffin wax, and not more than 1¼ parts of carnauba wax.

Pesticidal Coating Compositions

U. S. Patent 2,788,320. Paul Bracey, London, Eng., assignor to National Research Development Corp., London, Eng., a British corporation.

A method of controlling the rate of release of pest-controlling substance from a film produced from a coating composition comprising a lacquer solvent and an organic solvent-soluble aminoplastic resin and plasticizer therefor, together with an organic solvent-soluble pest-controlling substance in a quantity sufficient to exhibit its function at the surface of the film, which comprises skin hardening the surface of the film without materially affecting the interior thereof by irradiating said film with ultra-violet radiation.

Wax Coating Composition

U. S. Patent 2,791,570. Peter Stanley Backlund, Anaheim, Calif., assignor to Union Oil Co. of Calif., Los Angeles, Calif., a corporation of California.

A composition having high sealing strength and being suitable for use in coating food wrapping paper and paper containers, said composition comprising at least two different distillate fractions of slack wax, a lower boiling fraction and a higher boiling fraction, which fractions have been separately deoiled, and between about 0.5% and 5% based on the wax of a polyolefin having a molecular weight between about 8,000 and about 20,000, said lower boiling fraction consisting of material within the first 50% overhead and said higher boiling fraction consisting of material within the 50% to 95% overhead obtained in the fractional distillation of slack wax.

Coating Containing Flatting Agents

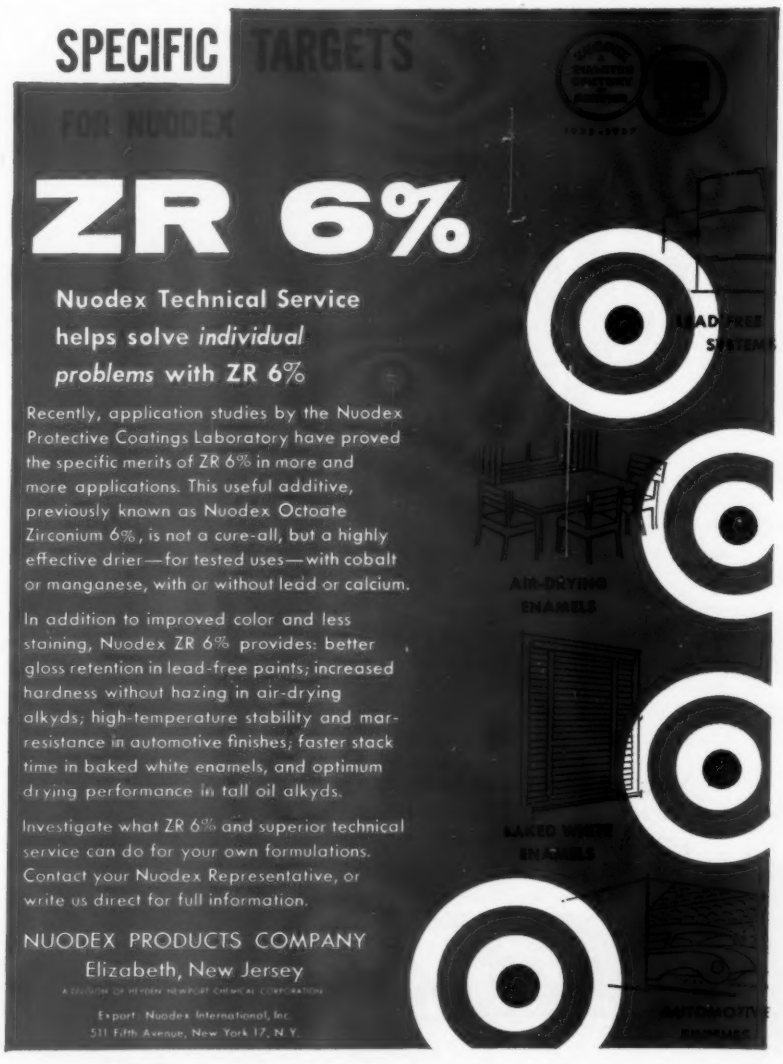
U. S. Patent 2,793,196. Robert W. Mason, Newark, Del., assignor to E. I. duPont de Nemours & Co., Wilmington, Del., a corporation of Delaware.

A process for flatting a synthetic resin coating formulation containing a solvent and pigmenting ingredient to reduce to zero the specular reflection thereof on application and adherence to a surface to be protected, comprising incorporating in such formulation, in which the synthetic resin is selected from the group consisting of melamine formaldehyde, urea formaldehyde, phthalic acid alkyd resins and mixtures thereof, a small amount of a flatting agent comprising an organic phosphate ester selected from the group consisting of acid phosphate mixed long chain organic esters and their amine salts.

Vinyl Protective Coating

U. S. Patent 2,792,376. Raymond G. Binkley, Van Nuys, Calif., assignor to Permaplate Corp., Los Angeles, Calif., a corporation of California.

A coating composition comprising finely divided metal particles selected from the group consisting of magnesium, aluminum and stainless steel and having an average screen size less than about 325 mesh, and polymerized vinyl-resin selected from the group consisting of polymerized vinyl chloride resin and co-polymerized vinyl chloride and vinyl acetate resin in a ratio of metal to resin between about 4:1 and about 7:1 in a solvent vehicle, the said vehicle including a solvent portion comprising predominantly methyl ethyl ketone and including also a blending portion consisting essentially of a mixture of tolu-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Nuodex Technical Service helps solve individual problems with ZR 6%
Recently, application studies by the Nuodex Protective Coatings Laboratory have proved the specific merits of ZR 6% in more and more applications. This useful additive, previously known as Nuodex Octoate Zirconium 6%, is not a cure-all, but a highly effective drier—for tested uses—with cobalt or manganese, with or without lead or calcium.
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ene and ethylene dichloride in a ratio between about 3:1 and about 4:1, the ratio of the said solvent portion to the said blending portion being approximately 3:1.

Wood Stain Filler Compositions

U. S. Patent 2,792,387. Carl Berger and Walter S. Hogue, Dayton, Ohio, assignors to the Commonwealth Engineering Co. of Ohio, Dayton, Ohio, a corporation of Ohio.

A wood staining and filling composition comprising as a coloring dye for the wood a reaction product of a flavanoid with aluminum chloride produced by refluxing the mixture in carbon disulfide and extracting the resultant brown colored reaction product with organic solvent, said flavanoid comprising a polyhydroxy methoxy flavanone, said flavanone selected from the group consisting of hesperidin, hesperidin chalcone, and hesperetin and mixtures thereof, said reaction product being disolved in a solvent.

A process of producing a wood staining and filling composition comprising the steps of reacting polyhydroxy methoxy flavanones with aluminum chloride produced by refluxing the mixture in carbon disulfide and extracting the resultant brown colored reaction product with organic solvent, dissolving the resultant reaction product in organic solvent to produce a wood staining composition said flavanones being selected from the group consisting of hesperidin, hesperidin chalcone and hesperetin.

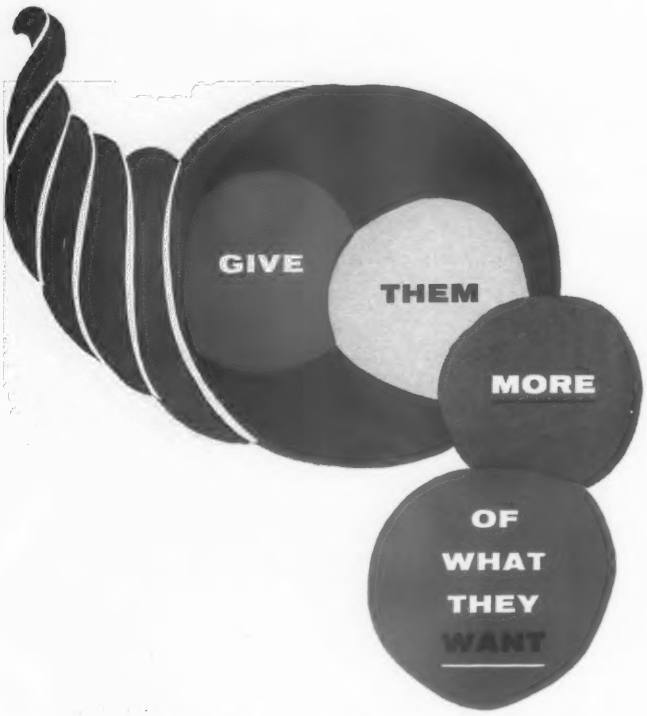
As a new product, a wood staining and filling composition comprising the reaction product of a polyhydroxy methoxy flavanone with aluminum chloride produced by refluxing the mixture in carbon disulfide and extracting the resultant brown colored reaction product with organic solvent said flavanoids being selected from the group consisting of hesperidin, hesperidin chalcone and hesperetin and mixtures thereof and admixing an inorganic filler with the resultant reaction product and dispersing the mixture in water to form a wood staining and filling composition.

Wood Stain Filler Composition

U. S. Patent 2,792,386. Carl Berger and Walter S. Hogue, Dayton, Ohio, assignors to the Commonwealth Engineering Co. of Ohio, Dayton, Ohio, a corporation of Ohio.

A wood staining and filling composition comprising as a coloring dye for the wood a reaction product of polyhydroxy flavanone with cyanuric chloride, aluminum chloride dissolved in carbon disulfide, said flavanone being selected from the group consisting of naringin, hesperidin, hesperidin chalcone and hesperetin.

A process of producing a wood staining and filling composition comprising the steps of reacting a polyhydroxy flavanone with cyanuric chloride and aluminum chloride, and dissolving the resultant reaction product in organic solvent to produce a wood staining composition, said flavanone being selected from the group consisting of naringin, hesperidin chalcone and hesperetin.



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VELSICOL

The author continues his random reflections on various aspects of the paint industry. The opinions expressed in this column are his alone and do not necessarily reflect those of this publication.

Ultrasonics

UNTIL a few years ago the utilization of sonic energy was regarded as a laboratory toy, interesting, but entirely impractical. Yes, a voice could shatter glass, but—so what! Now sonic energy is recognized as a powerful and valuable tool that can do many kinds of jobs—both in testing and analysis and in the processing of materials—better, faster, and more economically than was ever dreamed possible.

In the past half dozen years the scientific utilization of sound waves and sonic energy has created an entire new industry and has caused revolutionary changes in several broad areas. It may not be too much to say that in years to come, along with atomic energy and solar energy, the 20th century may well be remembered for the harnessing of sonic energy.

Although sound waves of all frequencies have been shown to be useful in a variety of technical fields, ultrasonic sound waves seem to offer the greatest potentialities. This calls for a brief explanation.

Our ears detect sound waves that vibrate from about 20 to about 20,000 cycles per second. This is sonic sound. Sound waves that vibrate less than 20 are infrasonic, more than 18,000 to 20,000 ultrasonic. Both infrasonic and ultrasonic sound are generally inaudible to the human ear.

Phil Heiberger

There is still some confusion surrounding these terms. Sound above the audible range was originally called supersonic, but that word was appropriated by the aerodynamicists to describe speed beyond the velocity of sound. The difficulty has now been resolved by common agreement on the definitions of the prefixes. "Super" and "sub" refer to velocity; "ultra" and "infra" to frequency. Today the term "sonics" encompasses the analysis, testing, and processing of materials and products by the use of mechanical vibrating energy.

General Applications

Many remarkable things can be done with "silent sound." For example, we can "sonograph" (as with light waves we photograph) the inner structure of bodies that are opaque to light. This is because sound waves penetrate many solids and liquids more readily and more deeply than x-rays. By sound absorption techniques related to light absorption spectroscopy, the molecular arrangements of many organic liquids can be inferred. Because variations in either the composition or in the flow velocity can be detected by acoustics, many opportunities exist for automatically controlling industrial processes.

In these applications, sound is used simply as a measuring stick or flashlight—if power is expended, it is small and incidental.

In another group of applications, it is the acoustic power that is utilized. For example, vibrational energy is used to drill rock, to machine complicated parts, and to engrave jewelry. As a microagitator, sound will emulsify liquid mixtures and speed up homogenization and dispersion processes. Complicated parts can be cleaned by sonic cavitation. Because interface effects play such a powerful role, the intense sonic vibrations can affect colloidal distributions, equalize electrolytic concentrations, speed up aging processes, precipitate aerosols, or degas foams.

Meaning of Cavitation

In practice, ultrasonic devices are used in conjunction with liquids or with solids in a liquid phase. Ultrasonic devices are divided into two broad classes, characterized

either by the presence or absence of "cavitation." Cavitation or "cold-boiling" may be set up in liquids when the applied sound pressure is of sufficient amplitude to cause continuous rupture of the entrapped vapor bubbles. The forces developed in the immediate locale of such collapsing bubbles are in the order of several hundred atmospheres pressure even though only a fraction of this pressure is required to initiate the process.

When cavitation is purposely developed, for example, to clean metal, glass, or plastic parts immersed in a solvent or detergent solution, the soils, greases, chips, and other contaminants are literally torn away by the tremendous forces associated with cold-boiling.

On the other hand, ultrasonic gaging and inspection systems and other instrumentation generally operate at lower sound pressures, which are below the so-called "threshold of cavitation." The familiar sonar equipment and related depth sounders and liquid level gages transmit pulses of moderate power which return as echoes some intervals later. Should the power deliberately be raised past the threshold of cavitation, the long distance performance would be severely limited by the scattering effects of the cavitation bubbles on subsequent sound waves.

Transducers

Sound waves may be generated by moving diaphragms or pistons, by devices that interrupt a fluid flow (sirens, jets, valve oscillators), or by slabs of materials that contract and expand under the influence of magnetic or electric fields. For most commercial applications, ultrasonic waves are produced by directing an electric current through either nickel rods or quartz or ceramic crystals which convert the electrical energy into mechanical vibrations. Instruments that do this are called transducers.

As a rule, the use of each type of transducer is limited to some specific frequency range. Another important quantity is the sound absorption of the medium, for the range of penetration is thus determined. Therefore an important task of the sonic engineer is to determine first, the optimum frequency range from the point of view of the desired end result, and second, to pick the type of transducer that is most efficient in this range.

Most of the above information was obtained from T. F. Hueter's article, "Sonic Techniques for Industry," which appeared in the October 26, 1956 issue of SCIENCE.

In "Ultrasonics," in the September, 1955 issue of RESEARCH AND ENGINEERING, Robert L. Rod, President of Acoustica Associates, Inc., describes several practical ultrasonic applications. Some of these seem to be a "natural" for particular areas of the paint industry. The most pertinent are listed below.

Cleaning and Degreasing

Cleaning and degreasing are facilitated because cavitation reduces almost instantaneously the surface tension of clinging soils, not only on visible surfaces, but in the deepest recesses, blind holes, and voids. Also, greases and oils are emulsified, further assisting the soil removal. The violent motion of the liquid imparts a surface scrubbing action that expedites cleaning. Ultrasonics can be added to existing vapor-degreasing and solvent washing machines, leading to complete automation.

Non-Destructive Thickness Testing

Two techniques are presently in use for ultrasonic thickness testing. The pulsed-type equipment functions on principles similar to radar by measuring the elapsed time required for a burst of sound energy to pass through a material from one surface to the opposite face and back again as an echo. From the known velocity of propagation, the thickness of the gaged piece can be determined from a knowledge of the transit time. A second type of equipment employs a variable frequency oscillator that is tuned until a standing wave of sound energy is set up in the material. Because the frequency and wave length are related to the sound velocity, it is possible to determine thickness of the material once the frequency is such that resonance is established. For example, the effect of rust damage, erosion, and corrosion may be observed.

Impregnation

Ultrasonically induced impregnation is useful in oiling bearings and other parts having inaccessible surfaces as well as treating porous material with preservatives. The application of fungicides to complex structures is also facilitated.

Emulsification Processes

The agitating action of cavitation makes emulsification easier and more rapid.

Pigment Dispersion, Particle Size Reduction

Particles within a sound field of cavitation level strike each other with tremendous force, causing almost instant disintegration and size reduction which is molecular in many cases.

Continuous Viscosity Measurement

One ultrasonic viscosimeter is based on the use of a thin knife-like blade immersed in the liquid under measurement. The blade is periodically vibrated by a transducer that is disconnected after the blade reaches steady state conditions. The rate at which the wand vibrations are damped by the liquid after the driving force is removed is a measure of viscosity. This type of instrument is suitable for low-cost remote gaging and recording.

Degassing

A considerable degree of rapid degassing takes place in liquids through which comparatively high frequency sound vibrations are passed.

Homogenization and Sterilization

On a laboratory scale, the beneficial results of ultrasonics in homogenization and sterilization of bacteria-laden liquids are recognized. The vibration demolishes bacteria cell walls.

Bleaching

The uniformity of conventional bleaching processes is enhanced as a result of the improvement in penetration induced by cavitation.

Particle Precipitation

Aerosols exposed to intense ultrasonic energy tend to agglomerate over a range of diameters not affected by conventional electric precipitators.

It seems clear that the paint industry stands to gain from recent advances in acoustic phenomena. Of course, much pioneer work will have to be done by liaison teams of both acoustic and paint experts, and huge sums will have to be invested. But the rewards will surely be great for investigators of daring imaginations.

NEWS

ADM Lists Expansion Here and Overseas

A new paint laboratory has been completed at the Archer-Daniels-Midland research center in Minneapolis. The new installation has been described as a miniature paint factory.

Research facilities include a main laboratory, industrial resins laboratory and water washed and pressurized spray finishing room. Eighteen paint chemists and four laboratory assistants work in the new unit.

Also announced by ADM has been the expansion of the firm's Pensacola, Fla., resin plant. New equipment has been installed to produce ADM's line of Aroplaz alkyd resins.

The expansion has been attributed to the growth of the southern market. According to W. G. Andrews, vice president and manager of the resin and plastics division, production of the Pensacola plant will go entirely to the protective coatings industry in the South.

ADM paint lab chemists test new paint formulas in the recently-completed paint laboratory at the firm's research center in Minneapolis.

The firm has also disclosed an expansion move into Italy. T. L. Daniels, ADM president, said the firm has licensed one of Italy's largest resin manufacturing concerns, Azienda Lavorazione Colori Resine e Affini, to make a number of ADM products on a royalty basis.

Mr. Daniels said the Italian firm would soon begin production of synthetic resins, copolymers, plasticizers and foundry core oils and binders.

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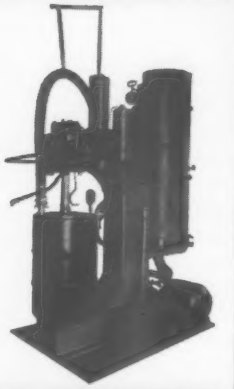

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95 Madison Avenue New York 16, N. Y.

EUROPEAN VIEWS

(*From page 51*)

These resins might become very important raw materials in the near future.

The writer's last stop before returning to New York was England, and it included a visit to a large British paint plant in Erith, Kent. The British are noteworthy for their predilection for one-roll mills. Characteristically, the plant, which employs 150 workers, had only two small pebblemills. The company ships a good part of its production to the tropics, where resistance to mold and bacteria is a major problem. The plant laboratory does intensive research work on fungicides.

London is the most amazing blend of age-old tradition with modern achievements. New London Central Airport, completed only two years ago, is a proud monument of Britannia ruling the air.

On the other hand, it is astonishing to hear that the city of London is erecting apartment buildings without central heating. And if one wishes to be transposed to the times of Charles Dickens, one need only step into one of the old banks in the heart of the city. The clerks do not use goose quills anymore, but otherwise little seems to have changed since Oliver Twist met the Artful Dodger on the road to London.

•

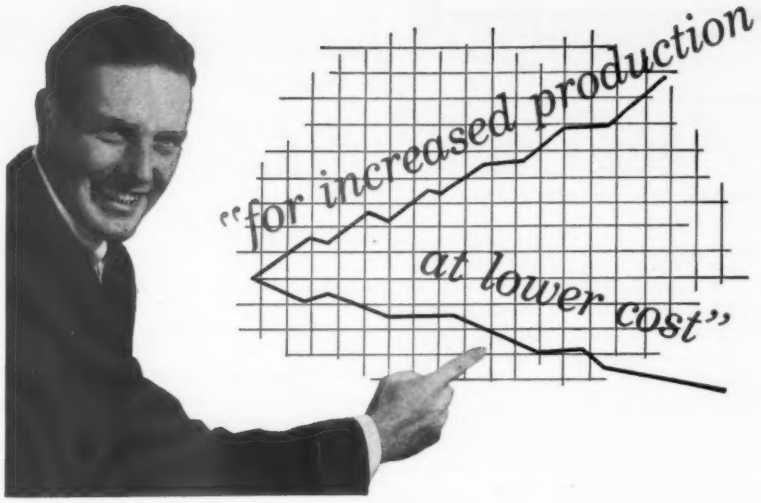
Glidden To Restore Plant

The Glidden Co. has announced plans to restore approximately two-thirds of its fire damaged paint plant buildings.

The burned buildings will be completely modernized and re-equipped to provide the firm with the same productive capacity that it had before the fire.

According to A. D. Duncan, vice president and general manager of the paint division, every device available for safety and fire protection will be installed.

Only one section of the Glidden plants affected by the recent fire must be razed, and demolition work has already begun, according to the company.



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Over-all milling time is reduced by milling a heavier, higher solid-content paste (less volume to mill for same number of cans of finished product).

Milling time is further reduced because a partial dispersion is obtained by taking advantage of internal shearing forces, developed only in a stiff paste.

Photo at left shows DAY hydraulic lift truck for extra speed and convenience in handling cans. Available as optional equipment. For complete information on all DAY pony mixers write for free Bulletin 500.

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STATISTICAL

(*From page 59*)

Table III represents the details of the analysis of variance for ZST. The procedure used is exactly the same as that for the conversion data.

Conclusions

The effect of catalyst in the range studied is to change conversion at the rate of 0.93 ± 0.72 units per increment of catalyst concentration change, where ± 0.72 units represent the 95% confidence range. The 95% confidence interval is the length of the interval which covers the true value in 95% of the cases in which it is used.

The effect of catalyst in the range studied is to change ZST 21.4 ± 19.4 units per increment of catalyst concentration change, where ± 19.4 units represent the 95% confidence range.

Figure 2 shows a plot of the data for conversion and ZST. The fact that a straight line fits the data so well is attested to by the very small value for the quadratic portion of the catalyst sums of squares. In other words, the linear term accounts very well for the variation due to changing catalyst concentration. See page 58.

Neither conversion nor ZST was significantly affected by monomer blend ratio.

In terms of plant operating conditions the most important conclusion is that no special care is needed to control the blend ratio of fresh to recycle monomer in the purified feed to the polymerization section. A second conclusion is that, in the range studied, changing catalyst concentration changes both conversion and ZST in the same direction. This means that, when advantage is taken of the increase in conversion afforded by increasing catalyst concentration, a higher ZST is to be expected.

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Blend Ratio	Catalyst Concentration 1	2	3	Row Totals
1	-18	8	21	11
2	-15	-15	6	-24
Column Totals	-33	- 7	27	-13

$$\text{Correction Term} = \frac{(\Sigma X_i)^2}{N} = \frac{(-13)^2}{42} = 4.02$$

$$\text{Total Sum of Squares} = \Sigma X_i^2 - \text{C. T.} = 1055 - 4.02 = 1050.98$$

$$\text{Sum of Squares for Blend Ratio} = \frac{(11)^2 + (-24)^2}{21} - 4.02 = 29.17$$

$$\text{Sum of Squares for Catalyst Concentration} = \frac{(-33)^2 + (-7)^2 + (27)^2}{14} - 4.02 = 129.33$$

$$\text{Sum of Squares for Catalyst Concentration X Blend Ratio Interaction} = \frac{(-18)^2 + (8)^2 + (21)^2 + (-15)^2 + (6)^2}{7} - (29.17 + 129.33 + 4.02) = 25.33$$

The two degrees of freedom associated with catalyst concentration have been partitioned (5) as follows:

A. For Linear Term

Linear Coefficients	Column Totals	Products of Coefficients and Column Totals
1	-33	-33
0	- 7	0
-1	27	-27
		-60

$$\text{Mean Square for Linear Term} = \frac{(-60)^2}{14\left[(1)^2 + (-1)^2\right]} = 128.57$$

B. For Quadratic Term

Quadratic Coefficients	Column Totals	Products of Coefficients and Column Totals
-1	-33	33
2	- 7	-14
-1	27	-27
		- 8

$$\text{Mean Square for Quadratic Term} = \frac{(-8)^2}{14\left[(-1)^2 + (2)^2 + (-1)^2\right]} = 0.76$$

Source of Variation	Degrees of Freedom	Sum of Squares	Mean Square	F	F .05
Blend Ratio	1	29.17	29.17	1.14	4.1
Catalyst Concentration					
Linear Term	1	128.57	128.57	5.05	4.1
Quadratic Term	1	.76	.76	0.03	4.1
Interaction	2	25.33	12.67	0.50	3.2
Error	34	867.14	25.50		
Total	39	1050.98			

$$\text{Slope of conversion line} = \frac{10}{(14)(2)}\left[27 - (-33)\right] = 21.4 \ \frac{\text{units}}{\text{catalyst increment}}$$

$$\hat{\sigma}_{\text{slope}} = 10\left[\frac{25.50}{28}\right]^{1/2} = 9.54 \qquad (1)$$

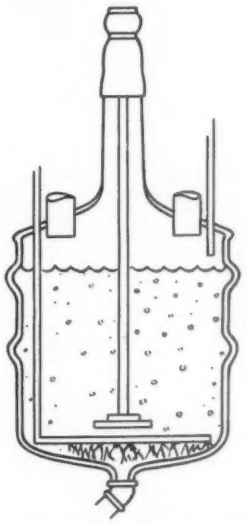
$$95\% \text{ confidence range of slope} = \pm \hat{\sigma}_{\text{slope}}\, t_{(.05,34)} = \pm (9.54)(2.03) = \pm 19.4$$

95% confidence interval: 2.0 to 40.8

Table III. Details of the analysis of variance for ZST.

CO_2 Proves New Aid to Resin Production-Cuts Costs-Improves Quality-Saves Time

Actual Tests Prove CO_2 Cuts Oil Cooking Time 2/3!



Actual tests conducted in the laboratories of a major manufacturer* produced these conclusive findings:

CO_2 sparging, added to conventional mechanical agitation, cuts cooking time from 720 to 235 minutes! To achieve this remarkable saving, CO_2 functioned in 2 important ways—

1. Sparged up through the mixture, CO_2 markedly increased agitation, causing faster, more even cooking.
2. Water is "swept" away. Passing up through the mixture, the CO_2 bubbles absorbed water vapor from the product—allowing the mixture to reach the desired cooking temperature sooner.

Tests Verify Another Important Fact—CO_2, when sparged through the reaction mixture, inerts it—effectively inhibits oxidation—color stays desirably light and constant.

*Name on request

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CO_2 in thinning tank retards oxidation, provides a fireproof "blanket."

Storage

CO_2 "blanket" in storage tank prevents "skinning."

Transfer

Under pressure from the CO_2 System, carbonic gas is the safest transfer medium for flammable fluids.

Filtration

CO_2 used to purge filters recovers the oil from the filter, substantially reduces cleaning time and frequency of cleanings.

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Inerting with CO_2 prevents "skinning," eliminates costly cleanouts.

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As inert, heavier-than-air "blanket," CO_2 gas effectively displaces oxygen, eliminates possibility of fire or explosion.

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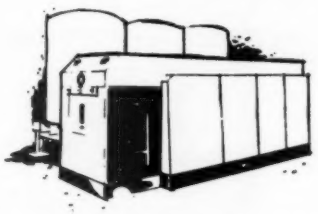

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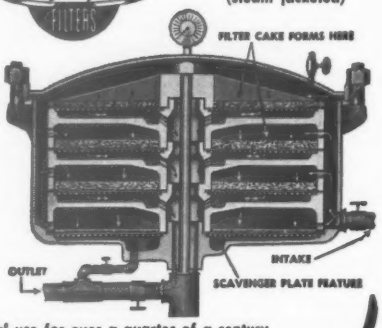

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A scholarship to assist senior high school teachers in completing further studies has been established by National Starch Products Inc.

Named the Alfred A. Halden Memorial Scholarship after the late manager of the Plainfield, N. J., plant and executive vice president and director, the scholarship is open to teachers of the Plainfield High School.

Recipients will be selected on the basis of ability, purpose in taking graduate study and financial need, by a committee composed of the principle and two teachers of the school, representatives of the Board of Education, and Dr. Robert Merritt, National Starch vice president of manufacturing.

CALENDAR OF EVENTS

August 19-23—Organic Coatings Conference, 1957 Gordon Research Conferences, Kimball Union Academy, Meriden, N. H.

October 30- November 2—Annual Convention, Federation of Paint and Varnish Production Clubs, and Paint Industries' Show, Bellevue-Stratford Hotel, Philadelphia, Pa.

November 4-6—70th Anniversary Meeting of National Paint, Varnish and Lacquer Assoc., Sheraton-Park and Shoreham Hotels, Washington, D. C.

Production Club Meetings

Baltimore, 2nd Friday, Park Plaza Hotel.

Chicago, 1st Monday, Furniture Mart.

C.D.I.C., 2nd Monday.
Cincinnati — Oct., Dec., Mar., May, Hotel Alms.
Dayton — Nov., Feb., April, Suttmilers.
Columbus — Jan., June, Sept., Fort Hayes Hotel.

Cleveland, 3rd Friday, Harvey Restaurant.

Dallas, 1st Thursday after 2nd Monday, Melrose Hotel.

Detroit, 4th Tuesday, Rachham Building.

Golden Gate, 3rd Monday, El Jardin Restaurant, San Francisco.

Houston, Monday prior 2nd Tuesday, Ship Ahoy Restaurant.

Kansas City, 2nd Thursday, Pickwick Hotel.

Los Angeles, 2nd Wednesday, Scully's Cafe.

Louisville, 3rd Wednesday, Seelbach Hotel.

Montreal, 1st Wednesday, Queen's Hotel.

New England, 3rd Thursday, University Club, Boston.

New York, 1st Thursday, Brass Rail, 100 Park Ave.

Northwestern, 1st Friday, St. Paul Town and Country Club.

Pacific Northwest, Annual Meetings Only.

Philadelphia, 3rd Wednesday, Philadelphia Rifle Club.

Pittsburgh, 1st Monday, Gateway Plaza, Bldg. 2.

Rocky Mountain, 2nd Wednesday.

St. Louis, 3rd Tuesday, Kings-Way Hotel.

Southern, Annual Meetings Only.

Toronto, 3rd Monday, Oak Room, Union Station.

Western New York, 1st Monday 40-8 Club, Buffalo.

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(*From page 45*)

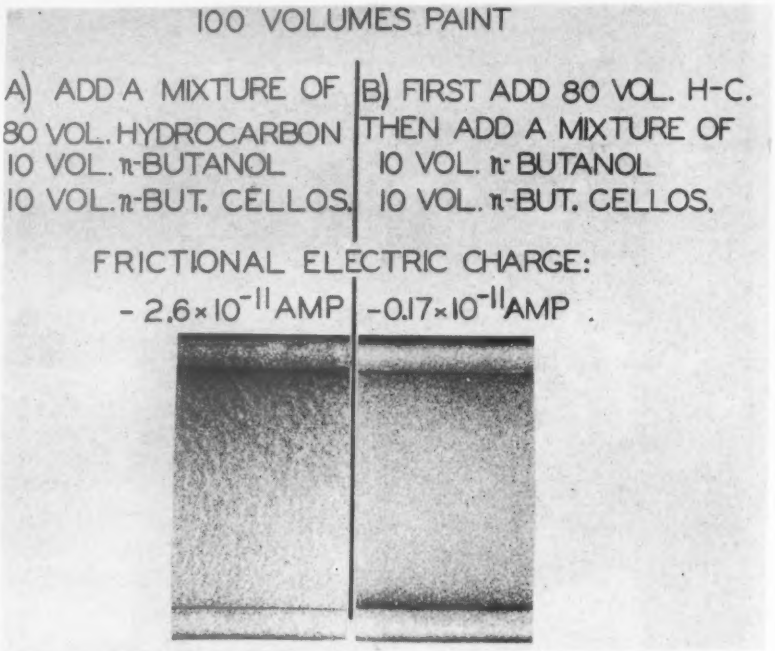

Figure 3. Effect of order addition of thinners on electrical neutrality.

that electrical neutrality and optimum results were not only dependent upon the kind of thinner used, but depended also on the order in which these liquids were added to the paint. (See Figure 3.) Thus, two paints of identical composition, viscosity, drying characteristics, etc., resulted. However, when electrostatically sprayed, only one of these paints gave good results.

During the usual commercial spraying operation without external electric field (hand spraying), the cloud of paint spray shows an electric charge. Currents varying from positive 1×10^{-8} Amp to negative 1×10^{-8} or more have been observed to flow between ground and the object to be painted.

The electrification of the spray can be increased or decreased through the use of properly formulated thinners.

A more uniform distribution of the metallic effect exists in the final coatings obtained from polychromatic paint compositions which produce a minimum of frictional electricity on agitation.

The frictional electricity generated on spraying of commercial paints is small when compared to the current flow in an electrostatic spray booth. However, the frictional electrification which accompanies the mechanical agitation of a paint seems to be indicative of those conditions which influence the distribution pattern of the metallic effect.

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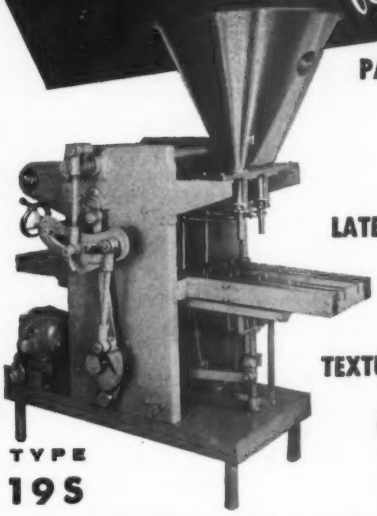
To reach first electrical neutrality and as a second step to reach a viscosity of 16.0 sec. #4 Ford Cup (72°).

Stage of Reduction	Quantity added: Chemical Additive	Thinner	Spray Electrification (10^{-11} AMP.)	Viscosity (Seconds)
a	2.50 gal.	—	−1.8	—
b	0.50	—	+0.4	17.2
c	—	0.50	—	16.5
d	—	0.50	+0.2	16.0

Table III. Typical reduction of 10 gallons of Paint "E".

TAILOR-MADE for filling



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NEWS

Says Castor Oil Meets Needs

A more than adequate supply of castor oil to meet the world's requirements has been forecast by Eric G. Orling, president of Baker Castor Oil Co.

Mr. Orling said, "A recent report of an impending castor oil shortage is, in our opinion, unduly pessimistic. The effect of accelerated production of castor beans in the United States, the importance of the inter-planted Indian crops, and the ever-increasing production in certain foreign areas were ignored in the report recently publicized."

He went on to say that about 5,000 acres of caster beans are now grown in California, Arizona, Texas and the Mississippi Delta. He said the acreage could be expanded to a million within 23 years.

Mr. Orling estimated that the present yield per acre is approximately one ton, and said that it could be increased as technology advances.

Dow Lists Education Grants

A projected program of more than $600,000 in gifts to education in the 1957-58 academic year has been announced by the Dow Chemical Company.

The program is to include $167,150 in grants to 53 institutions for graduate fellowships and undergraduate scholarships, and to two educational foundations for assistance to deserving students.

Grants to educational institutions and foundations for use in expansion and operating programs and other educational activities are to total $142,850. An additional $300,000 is expected to be made available to colleges and universities for specific research projects which will be beneficial to Dow in the chemical field.

In addition to the grant-in-aid program, the firm announced a new matching grant program of aid to higher education.

Effective this month Dow will match its employees' contributions to educational institutions up to $100 a year per employee. Employees may make gifts to any accredited four-year college or university in the United States.

Scholarship grants being provided for the first time include two in paint chemistry at North Dakota Agricultural College.

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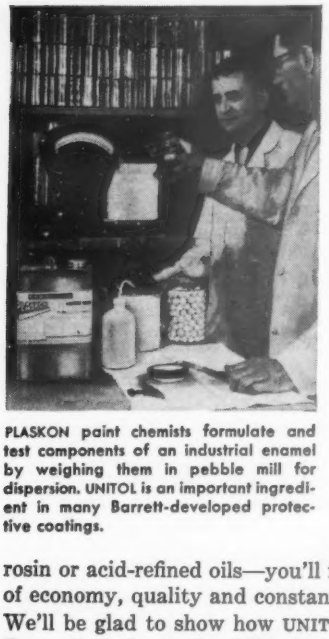

PLASKON paint chemists formulate and test components of an industrial enamel by weighing them in pebble mill for dispersion. UNITOL is an important ingredient in many Barrett-developed protective coatings.

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NEWS

100 Year Association Member

The Baker Castor Oil Co., a subsidiary of National Lead Co., has become a member of The Hundred Year Assoc. of New York, Inc.

J. Wilson Newman, president of the Association, presented Eric G. Orling, Baker president, with a plaque commemorating the occasion.

The firm was established in Jersey City, N. J., in 1857.

•

Rohm & Haas Releases Film

A 16 mm. color film titled, "The Story of Acrylic Paint," has been released by the Rohm & Haas Co.

The 20-minute sound film tells the story of the growth and uses of acrylic latex paints in the four years since they were first introduced to the paint industry.

The film is designed to provide practical background information for architects, builders, maintenance supervisors and paint contractors, as well as paint and hardware dealers and buyers.

The film explains the chemical story of acrylic latex in simple molecular animation.

•

Roon Competition Deadline

The Federation of Paint and Varnish Production Clubs has issued a reminder that papers to be entered for the Roon Awards competition must be submitted no later than August 1.

The competition is being held in two classes, one for Class A members, and an open class. Awards are $450, $250 and $175 for first, second and third places in both classes. The competition is for technical papers by individuals in the paint and varnish industry.

Entries are to be sent to Herbert E. Hillman, Chairman, Program Committee, c/o Eaglo Paint & Varnish Corp., 49-20 Fifth St., Long Island City 1, N. Y.

•

MCA Elects Hart

Ernest Hart, president of Food Machinery and Chemical Corp., was elected chairman of the Board of Directors of the Manufacturing Chemists' Assoc., at its 85th Annual Meeting last month at White Sulphur Springs, W. Va.

Harry B. McClure, vice president of Union Carbide Corp., was elected chairman of the executive committee, and General J. E. Hull, USA (Ret.), was reelected as full time president and a director.

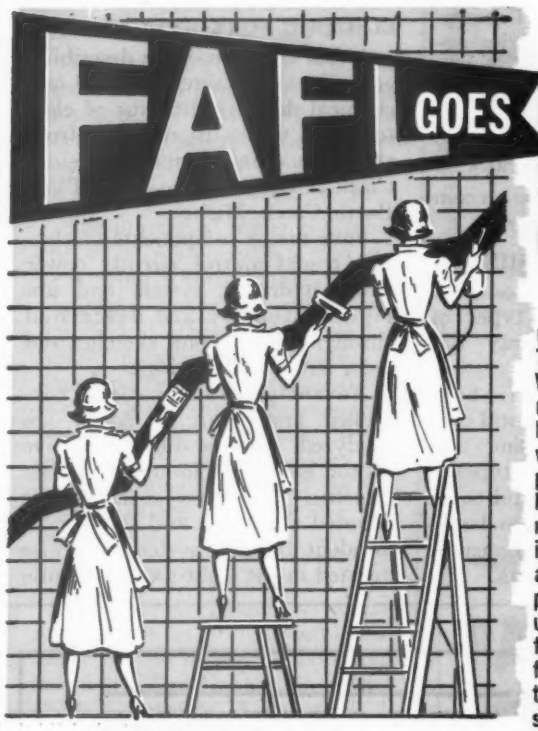
R. L. Murray, chairman of the board of Hooker Electrochemical Co., and D. S. Frederick, vice president of Rohm & Haas Co., were elected vice presidents.

M. F. Crass, Jr., was reelected full time secretary-treasurer.

Merit Scholarships Awarded

Twelve Pittsburgh Plate Glass Foundation Merit Scholarships have been awarded to high school seniors, it has been announced by the National Merit Scholarship Corp. of Evanston, Ill.

The Pittsburgh Plate Glass Foundation is one of the 57 leading American corporate donors of merit scholarships. The Foundation's scholarships are administered by the National Merit Scholarship Corp., and are designed for students concentrating in liberal arts, chemistry or physics, and in ceramic, chemical, mechanical, civil or electrical engineering.



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TECHNICAL Bulletins

LATEX PAINT

A 12-page pamphlet on latex paint by the Dow Chemical Co., Dept. PVP, Midland, Mich., gives some of the answers to frequent questions on the product.

Typical questions covered are: What is latex? Are there different kinds of latex? Are latex paints available for both interior and exterior? Are all latex paints much the same?

Also answered are: Do styrene-butadiene PVA (vinyl) and acrylic paints differ? Where can I recommend latex paints for interior application? Why are they better for interiors? Where can I recommend exterior type latex masonry paints? Why are they better for exterior masonry painting? Where must latex paints not be recom mended?

SPRAY FINISHING MACHINES

An illustrated catalog has been released covering basic types of automatic transverse spray finishing machines.

Four types are covered: horizontal straight line, horizontal contour, vertical straight line and vertical contour. The four types of transverse machines are said to be useful for most products in large-scale production and can be easily adapted for special products.

Copies of the catalog are available from The DeVilbiss Co., Dept. PVP, Toledo 1, Ohio.

FIRE DETECTORS

Unit fire detectors are covered in a four-page illustrated brochure offered by Fenwal Inc., Dept. PVP, Ashland, Mass.

The brochure describes the horizontal and vertical models available, states physical and electrical specifications, gives listings and approvals, and offers mounting suggestions for various types of installations.

Temperature settings for various models are also listed. Graphs compare response temperatures for various types of detectors under dynamic ambient conditions.

ELECTRIC FORK TRUCKS

A four-color brochure describing operational characteristics and mechanical details of its line of electric fork trucks is available from the Industrial Truck Division, Clark Equipment Co., Dept. PVP, Battle Creek, Mich.

Four major components of electric trucks-control circuit, power train, hydraulic system and upright assembly-are described through photographs, sketches and color cut-away drawings.

Advantages of automatically controlled first point of power are analyzed, and the dual field drive motor is defined in terms of user benefits. Features such as the pivoted steer axle and three independent braking systems are also treated in the eight-page brochure.

FILTER CARTRIDGE

The Cuno Engineering Corp., Dept. PVP, South Vine St., Meriden, Conn., has announced the release of an eight-page pamphlet describing the white cellulose "Micro-Klean" filter cartridge.

Included in the pamphlet are illustrations of the filter cartridge and specifications and flow ratings. Descriptive and engineering data covering the most popular sizes and models of standard housings for use with the cartridge are also given.

LITHIUM

"Presenting Lithium," a 15-page booklet describing the uses, properties, research potentials and availability of lithium is being issued by the newly formed American Lithium Institute, P.O. Box 549, Princeton, N. J.

HANDLING BULK MATERIAL

Information on equipment for storing and handling bulk materials is contained in a bulletin by The Day Sales Co., Dept. PVP, 810 Third Ave. N.E., Minneapolis, Minn.

Descriptions, specifications and dimensions of Day vertical and horizontal tanks are included in the ten-page publication. Pneumatic conveying systems, bulk material handling accessories and custom fabricating are also discussed.

The bulletin contains photos of typical bulk material tank installations in many fields.

PORTABLE BELT CONVEYOR

A four-page folder contains complete details on the lightweight Trojan "A" Series portable belt conveyor.

Titled 50AA, the folder details the features of the conveyor series. The information is directed to factories where time and cost of materials handling are under constant scrutiny. Information on available sizes is given, as well as drawings and charts of proper operational adjustments, integration with gravity and roller sections, detailed component specifications and optional equipment.

The folder is issued by The E. W. Buschman Co., Dept. PVP, Clifton and Spring Grove Aves., Cincinnati 32, Ohio.

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FUNGICIDE

A technical bulletin has been released describing Fungitrol 50, a colorless, highly active fungicide for use on cellulosic materials which can be used from both water and solvent systems.

Also available is a data sheet on Fungitrol 50, describing uses as a mildew resistant treatment for light and heavy duty fabrics, to prevent the degradation of paper to prevent the growth of surface fungi on wood.

Titled "Fungitrol 50 For Colorless Non-Toxic Cordage Preservation," the bulletin is available from Heyden Newport Chemical Corp.; Dept. PVP, 342 Madison Ave., New York 17, N. Y.

WRINKLE VEHICLES

Alkydol Laboratories, Inc., Dept. PVP, 3242 South 50th Ave., Cicero 50, Ill., has made available a bulletin describing phthalic alkyd and oleoresinous types of wrinkle vehicles.

The bulletin is called "Alkydol Wrinkle Vehicles" (Alkydol Reporter #4). It includes a physical description of the various wrinkle liquids, including compatibilities, specific application advantages, an outline of the wrinkle pattern variations and textures and drier, pigment and solvent recommendations.

The bulletin is a valuable reference for use by the wrinkle paint formulator.

RESINS MARKETING

An illustrated periodical titled "Coatings Parade" has been announced by Bakelite Co., a Division of Union Carbide Corp., Dept. PVP, 260 Madison Ave., New York 16, N. Y.

The first issue is now available. It contains articles on the marketing of resins for surface coatings, new coatings applications and recent technological developments in the field.

The lead article in the first issued discusses the promising market potential for epoxy resins and the firm's program for developing it. The article describes new applications for epoxy-base coatings and the efforts that have gone into the production of commercially attractive resins that can be adapted for use by formulators on their present equipment.

Other articles in the first issue introduce key Bakelite personnel concerned with development and sales of resins for surface coatings, describe new coatings literature and help to interpret current research as it may affect the coatings industry.

VISCOSITY CONVERSION CHART

An easy to use viscosity conversion chart is being offered by Technical Service Division, Cellofilm Industries, Inc., Dept. PVP, Woodridge, N. J. The chart is designed for use with nitro-cellulose base solutions.

The chart offers the ratings in poises from .10 to 5000 for 63 mediums. The chart is suited for wall or desk-top use.

EXPLOSION HAZARD FINDER

To locate the hidden probabilities of electrically ignited explosions in plants, a "Hazard Finder" has been prepared by Crouse Hinds Co., Dept. PVP, Wolf & Seventh North Streets, Syracuse, N. Y.

The illustrated folder contains a check list of 13 questions that help determine whether uncontrolled flammable gasses, vapors, dusts, liquids and other combustible materials make plants unsafe. A sealed portion of the folder, to be opened after the questions have been answered, evaluates the answers in terms of plant safety.

Evaluations are based on the findings of the National Fire Protection Assoc.

PNEUMATIC CONTROL

A bulletin on pneumatic control instruments featuring general automatic control theory has been published by The Bristol Co., Dept. PVP, Waterbury 20, Conn.

The 44-page bulletin describes in simplified terms and illustrations the basic concepts of narrow band, proportional, reset, derivative and reset plus derivative control actions. Also covered are selective control, cascade control and ratio control.

The bulletin also contains descriptions of the firm's line of pneumatic recording and indicating controllers, and information on sensing elements used with the instruments. Final control elements and accessories are listed.

Title of the publication is Al30.

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ADVERTISERS' INDEX

Abbé Engineering Co. ..... June
Advance Solvents & Chemical Div. Carlisle Chem. Works, Inc. 96
Alkydol Laboratories, Inc. 10
C. M. Ambrose Co. ..... June
American Cyanamid Co., (Pigments Div.) 79
American Cyanamid Co., (Plastics & Resins) ..... 3rd Cover
American Mineral Spirits Co. 73
American Zinc Institute 77
American Zinc Sales Co. 68
Archer-Daniels-Midland Co. ..... June
Arizona Chemical Co. 81
Atlas Electric Devices Co. ..... June
Bakelite Company, A Div. of Union Carbide Corp. 34, 35
Barrett Division, Allied Chemical & Dye Co. ..... June
The Borden Co. ..... June
Borg-Warner Corp., Marbon Chemical Division 23
California Ink Co. ..... June
Cargill, Inc. 95
Celanese Corp. of Amer., Chemical Div. 33
Celanese Corp. of Amer., Plastics Div. 14
Cellohim Industries, Inc. ..... June
Ciba Co. ..... June
Columbian Carbon Co., (Mapico Color Unit) ..... Insert 15, 16
Columbian Carbon Co. ..... Insert 15, 16
Commercial Solvents Corp. 13
Concord Mica Corp. 100
Continental Can Co. 63
Continental Carbon Co. ..... June
Davies Can Co. 102
Davison Chemical Co., Div. W. R. Grace & Co. 72
J. H. Day 91
Deutsche Hydrierwerke GMBH 97
Dicalite Division, Great Lakes Carbon Corp. 80
Dow Chemical Co. 64
DuPont de Nemours & Co., Inc., E. I. (Pigment Dept. Colors) ..... June
The Eagle-Picher Co. 74
Eastman Chemical Products Co., Inc. 8
English Mica Co. 94
Enjay Co., Inc. ..... June
Esso Standard Oil Co. 19
Farnow, Inc. 99
Fein's Tin Can Co. ..... June
Ferro Chemical Co. ..... June
Filpaco Industries ..... June
Firestone Plastics Co. ..... June
Flex-O-Lite Mfg. Corp. ..... June
Franklin Mineral Products Co. 101
General Dyestuff Co., General Aniline & Film Corp. ..... Insert 65
Georgia Kaolin Co. ..... 4th Cover
Georgia Marble Co. ..... June
L. M. Gilbert Co. 90
Glycerine Producers Ass'n. 17
T. F. Gowdy Co. 78
Grace Chemical Co. 84
Harshaw Chemical Co. 22
Harshaw Chemical Co. (Zinsser & Co., Inc.) 22
Heyden Newport Chem. Corp. ..... Front Cover
Herman Hockmeyer & Co. 71
Hope Machine Co. 87
Imperial Paper & Color Corp. ..... June
International Talc Co. ..... June
Johns Manville Corp. 48
Kellogg & Sons, Inc., Spencer 18
Kentucky Color & Chemical Co. 46
H. Kohnstamm & Co. 67
J. M. Lehmann Co. 66
Liquid Carbonic Corp. 93
Mapico Color Unit, Columbian Carbon Corp. ..... Insert 15, 16
Marbon Chemical Div., Borg-Warner Corp. 23
McDanel Refractory Porcelain Co. 42
Metals Disintegrating Co. ..... May
Metasap Chemical Co. ..... June
Minerals & Chemicals Corp. of America ..... June
Minnesota Linseed Oil Co. 9
Monsanto Chem. Co., (Organic Div.) ..... June
Monsanto Chemical Co., (Plastics Div.) ..... Insert 25, 26, 27, 28
Naftone, Inc. 76
National Aniline Div., Allied Chem. & Dye Corp. 3
National Can Corp. ..... June
National Lead Co. 11
Neville Chemical Co. 21
New Jersey Zinc Co. 41
Newport Industries Inc. (Heyden Newport Chem. Corp.) ..... Front Cover
Nopco Chemical Co. 75
Nuodex Products, Inc. 85
Oronite Chemical Co. 52
Pacific Vegetable Oil Co. 82
G. H. Packwood Mfg. Co. ..... June
Patterson Foundry & Machine Co. ..... June
Pennsalts Chemicals, Industrial Div. 36
Pennsylvania Industries Chem. Co. ..... June
Phillips Petroleum Co. 49
Photovolt Co. 90
Pittsburgh Coke & Chemical Co. ..... June
R-B-H Dispersions 86
Reichhold Chemicals, Inc. 4
Rohm & Haas Co. ..... June
Chas. Ross & Son Co. 20
Shawinigan Resins Corp. 12
Shell Chemical Co. ..... 2nd Cover
Shell Oil Co. 6
Sinclair Chemicals, Inc. ..... May
Smith Chemical & Color Co. ..... June
Socony-Mobiloil Co., Inc. 47
Solvents & Chemicals Group 40
Sparkler Mfg. Co. 94
Standard Oil Co., Indiana (Amoco Chems.) 43
Standard Ultramarine & Color Co. ..... Insert 53, 54, 55, 56
Tamms Industries, Inc. 97
Titanium Pigment Corporation 83
Troy Chemical Co. ..... June
Troy Engine & Machine Co. ..... May
Union Bag-Camp Paper Corp. 98
Union Carbide Corp. 24
U. S. Rubber Co., Naugatuck Chem. Div. ..... June
U. S. Stoneware Co. ..... June
Van Amerigen-Haebler, Inc. ..... June
Velsicol Chemical Corp. 87
Vulcan Steel Container Co. ..... May
Witco Chemical Co. ..... June
G. S. Ziegler & Co. ..... May
Zinsser & Co. Inc., Sub. Harshaw Chemical Co. 22
William Zinsser & Co. ..... June

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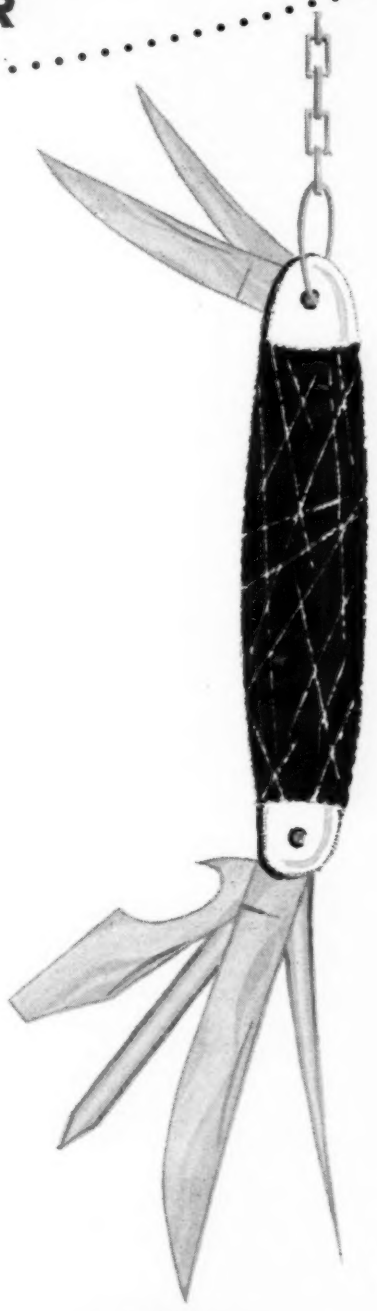

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